



SELECTED
 **WATER
RESOURCES
ABSTRACTS**



VOLUME 5, NUMBER 6
MARCH 15, 1972

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SELECTED WATER RESOURCES ABSTRACTS

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Office of Water Resources Research, U.S. Department of the Interior**



**VOLUME 5, NUMBER 6
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W72-02953 -- W72-03503

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

STATE OF WATER IN OSMOTIC PROCESSES, Scripps Institution of Oceanography, San Diego, Calif.
P. F. Scholander.
Microvasc Res. 3 (2): 215-232. Illus. 1971.

Descriptors: *Membranes.
Identifiers: Osmotic, Processes, Water.

Osmosis and imbibition depend on solute, or matrix, pressure respectively acting on a boundary. If the boundary is a semipermeable membrane, the pressure is due to the solute or matrix alone; if it is a free surface, the balance of forces gives negative pressure to the solvent, with a consequent lowering of the vapor pressure. Osmotic flux through a dialyzing membrane is purely hydraulic, and is not uniquely determined by vapor pressure and water potential; only in diffusional osmosis are these parameters determinants. Osmotic flux, or swelling, is caused by the gradient of the partial pressure of the water itself. This unified interpretation of osmosis and imbibition is based upon experimentally verified entities: negative fluid pressures; independence of solute and matrix from solvent at equilibrium; a fundamental role for the free solvent surface; and negative solvent pressure produced by drag under nonequilibrium conditions.—Copyright 1971, Biological Abstracts, Inc.
W72-03023

INFLUENCE OF MINERALOGY AND MICROORGANISMS ON IRON AND SULFIDE CONCENTRATIONS IN GROUNDWATER, Missouri Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W72-03147

SPECULAR REFLECTANCE OF AQUEOUS SOLUTIONS, Missouri Univ., Kansas City. Dept. of Physics.
M. R. Querry, R. C. Waring, W. E. Holland, and G. R. Mansell.
In: Proceedings of the Seventh International Symposium on Remote Sensing of Environment, May 17-21, 1971, University of Michigan. p 1053-1069, 10 fig, 30 ref.

Descriptors: *Instrumentation, *Analytical techniques, *Spectrophotometry, *Aqueous solutions, Sodium chloride, Sulfates, Phosphates.

Two laboratory instruments for measuring the specular reflectance of aqueous solutions were constructed. The instruments are an organic-dye-laser spectrophotometer for the 360-650 nm wavelength region and a reflectometer accessory for a Perkin-Elmer E-system spectrophotometer which will operate in the 0.2-20 micrometers wavelength region. The reflectometer accessory was used to measure the relative, infrared, specular reflectance in limited spectral regions for aqueous solutions of NaCl, K₂SO₄, ZnSO₄, (NH₄)₂SO₄, and NH₄H₂PO₄ with radiant flux incident at about 70 deg. and polarized perpendicular to the plane of incidence. The laser spectrometer was used to measure the absolute reflectance of aqueous solutions of NaCl in the wavelength region 575-610nm for light incident at angles of about 60 deg., 65 deg. and 70 deg. and polarized parallel to the plane of incidence. More extensive use of both instruments to obtain reflectance measurements of aqueous solutions is now under way.
W72-03176

02. WATER CYCLE

2A. General

CARIBOU-POKER CREEKS RESEARCH WATERSHED, INTERIOR ALASKA, BACKGROUND AND CURRENT STATUS, Cold Regions Research and Engineering Lab., Hanover, N. H.
C. W. Slaughter.
Available from National Technical Information Service, Springfield, Va. 22151, as AD-726 373, Price \$3.00. Cold Regions Research and Engineering Laboratory Special Report 157, May 1971. 11 p, 3 fig, 1 tab, 20 ref, append. DA TASK 4A062112A89401.

Descriptors: *Natural streams, *Watersheds (Basins), *Hydrology, *Ecology, *Alaska, Vegetation, Streamflow, Permafrost, Surveys, Investigations, Inter-agency cooperation, Air temperature.
Identifiers: *Caribou-Poker Creeks (Alaska), Research watershed.

The Caribou-Poker Creeks Research Watershed was established in 1969 as a site for cooperative, inter-agency investigation of hydrologic and related aspects of a subarctic environment. The relatively undisturbed 40-square-mile drainage basin includes both permafrost-dominated and nonpermafrost watersheds, and has a variety of vegetation communities. Research is directed to hydrologic behavior of north-facing (permafrost) and south-facing (non-permafrost) basins in this upland setting. Air temperature and precipitation are monitored at three elevations (mouth, 1600 ft and 2100 ft); water temperature is measured at two locations, and streamflow is measured at periodic intervals. Related work is underway dealing with soil moisture relations, nutrient cycling in a black spruce environment, and surface water chemistry. (Woodard-USGS)
W72-02957

COMPUTER APPLICATIONS IN HYDROLOGY, Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 07C.
W72-02958

TECHNIQUES FOR STUDYING THE PHYSICAL FACTORS OF THE BIOSPHERE, Marc Hallaire, Christian Perrin, De Brichambaut, and Charles Goillot.
Institut National de la Recherche Agronomique: Paris, France. 1970, 543 p, Pr. 86 Fr.
Identifiers: *Biosphere, Book, Physical, Techniques.

Emphasis in this work is on furnishing a total view of the techniques usable for measuring physical quantities: radiation, temperature, CO₂ and water vapor in the air, wind, precipitation, water potential or humidity in living or inert matter, transfer coefficients. Besides the factors measured directly, others are noted, such as fluxes which may require the simultaneous determination of different quantities from which they are derived. The main article of each chapter gives a general examination of the techniques and methods used for the measurement of the quantity being considered. The articles following are generally on perfections or adjustments treating more completely a particular technique. This work is addressed to ecologists, bioclimatologists, agrometeorologists, biophysicists and biochemists who, in teaching, research or application, are involved with problems of the environment and its influences on living beings. English and French summaries are provided.—Copyright 1971, Biological Abstracts, Inc.
W72-03027

RELATION OF RAINFALL ENERGY AND STREAMFLOW TO SEDIMENT YIELD FROM SMALL AND LARGE WATERSHEDS, Agricultural Research Service, Coshocton, Ohio.
For primary bibliographic entry see Field 02J.
W72-03159

DECISION MAKING UNDER UNCERTAINTY IN SYSTEMS HYDROLOGY, Arizona Univ., Tucson. Hydrology and Water Resources Interdisciplinary Program.
For primary bibliographic entry see Field 06A.
W72-03166

SYMPOSIUM ON THE RESULTS OF RESEARCH ON REPRESENTATIVE AND EXPERIMENTAL BASINS.

Proceedings of Symposium of Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, 1970. 737 p.

Descriptors: *Rainfall-runoff relationships, *Runoff forecasting, *Streamflow forecasting, *Water balance, *Demonstration watersheds, Time series analysis, Statistics, Hydrology, Hydrogeology, Research and development, Conferences, Statistical methods, Mathematical models, Statistical models.
Identifiers: *Representative watersheds, *Experimental watersheds.

The IASH symposium on the results of studies of representative and experimental watersheds was an opportunity for scientists to discuss common problems and compare progress. The subject was divided into five topic sessions. The topics are: (1) hydrological processes; (2) application of experimental design techniques for the estimation of the significance of cultural changes on experimental basins, and the application of statistical techniques to the nonhomogeneity and time variance of short sequences and the extrapolation of short-time series; (3) results of research on a basin and on a regional basis; (4) determination of representativeness of representative basins, including extrapolation of data and research results in space, application of hydrological classification of basins; and (5) general development of new techniques. (See also W72-03248 thru W72-03281) (Knapp-USGS)
W72-03247

AREAL PATTERNS OF RAINFALL IN A SMALL WATERSHED AS AFFECTED BY WIND AND METEOROLOGICAL CONDITIONS, Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 02B.
W72-03248

WATERSHED AREAS CONTRIBUTING TO RUNOFF, Guelph Univ. (Ontario). School of Engineering.
W. T. Dickinson, and H. Whiteley.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 12-26, 1970. 5 fig, 4 tab, 20 ref.

Descriptors: *Rainfall-runoff relationships, *Water balance, Depth-area-duration analysis, Infiltration, Runoff, Overland flow, Rainfall disposition, Base flow, International Hydrological Decade.
Identifiers: Contributing area (Runoff), Representative watersheds.

The response of streamflow to precipitation input on Blue Springs Creek, an I.H.D. Representative Basin, was analyzed in light of the contributing area concept. The streamflow was separated into baseflow and storm runoff, the baseflow being estimated from flows measured at springs on the basin. The minimum contributing area (defined as

Field 02—WATER CYCLE

Group 2A—General

that area which contributing 100 percent of the effective rainfall would yield the measured storm runoff) was evaluated for each precipitation event. These area values were related to measured soil moisture volumes. The minimum contributing area can vary widely, showing a range of values from 1% to 50%. The majority of values were below 10%, and a median value for rainfall events was 5%. When compared with actual basin segments, the minimum contributing areas appear to give a good indication of the approximate areal extent of those portions of the Blue Springs Basin contributing to runoff. (See also W72-03247) (Knapp-USGS)

W72-03249

STUDY OF SNOWMELT RUNOFF PROCESS IN TWO REPRESENTATIVE WATERSHEDS WITH DIFFERENT ELEVATION RANGE,
Swiss Federal Inst. for Snow and Avalanche Research, Davos-Weisfluhjoch.
J. Martinec.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 29-39, 1970. 7 fig, 3 tab, 10 ref.

Descriptors: *Snowmelt, *Depth-area-duration analysis, *Runoff, *Water yield, Temperature, Topography, Peak discharge, Hydrographs, International Hydrological Decade.

Identifiers: Representative watersheds.

Two mountain watersheds in Central Europe were selected to represent the hydrological regime substantially affected by snow accumulation. Factors governing the snowmelt runoff process are examined with regard to the respective size, morphology, elevation and climatic conditions to learn the values of the degree-day factor, recession coefficient and time of concentration. A nomography is given for converting runoff-depths over the respective areas to discharge. It can simplify day-to-day computations. Degree-day ratios increase with increasing snow density which is generally lower in the alpine region of Dischma than in Modry Dul, which is exposed to oceanic influence. The degree-day ratio includes wind speed, solar radiation, air humidity and barometric pressure. (See also W72-03247) (Knapp-USGS)

W72-03250

ANALYTICAL PROCEDURES FOR EVALUATING THE INFILTRATION AND EVAPOTRANSPIRATION TERMS OF THE WATER BALANCE EQUATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
F. X. Dunin, and A. B. Costin.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 39-55, 1970. 3 fig, 6 tab, 31 ref.

Descriptors: *Water balance, *Rainfall-runoff relationships, *Infiltration, *Evapotranspiration, *Review, Hydrologic budget, Mathematical models, Model studies, International Hydrological decade.

Identifiers: Australia, Representative watersheds.

Various approaches to modeling water balance are reviewed. For infiltration, the Philip equation with parameters for sorptivity and hydraulic conductivity provides a suitable method. This method requires ancillary measurements of soil moisture, and the development of rapid methods for evaluating soil variability. An example of the use of the Philip-equation approach on a field scale is given for a catchment in Victoria. Evapotranspiration, usually obtained by difference after measurement of the other terms of the hydrologic equation, is best measured by the energy partition method. However, this requires extensive replication which generally precludes its use on a catchment

scale. A compromise approach for predicting catchment evapotranspiration involves a combination method incorporating parameters for atmospheric and internal conductances. Analytical procedures are given for deriving these parameters from catchment studies in New South Wales. (See also W72-03247) (Knapp-USGS)

W72-03251

FLUCTUATION OF WATER TABLE OF SHALLOW GROUNDWATER OF PADDY FIELDS IN THE DOWNSTREAM BASIN OF THE AYA RIVER,

Kagawa Univ., Takamatsu (Japan). Faculty of Agriculture.

For primary bibliographic entry see Field 02F.

W72-03252

A SYSTEMS-ENGINEERING APPROACH TO THE PROBLEM OF INFLUENCED RUNOFF IN PLAIN CATCHMENTS, BASED ON OBSERVATIONS GAINED IN THE MIRHO-GYOLCS EXPERIMENTAL AREA,
Research Inst. for Water Resources Development, Budapest (Hungary).
G. Kienitz.

In: Symposium on the results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 83-93, 1970. 2 fig, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Drainage practices, *Mathematical models, *Systems analysis, Runoff forecasting, Drainage systems, Water control, Water management (Applied), Watersheds (Basins), Computer models, Simulation analysis.

Identifiers: Hungary.

On plain watersheds, such as those in many agricultural areas of Hungary, runoff originates only as a result of human interference, and the phenomenon of influenced runoff-as contrasted with the free concentration of waters in sloping areas-is encountered. A physical-mathematical model divides into four phases the concentration of waters on plain catchments. Sub-systems of the model correspond to these phases in a procedure of self-controlling analysis simulating the physical phenomenon. The computer method is suitable for the simulation of cases of runoff and water-logging observed in the Mirho-Gyolcs experimental area, Hungary. Possible uses of the method are in the field of hydrological forecasting as well as in the field of technical and economic planning. (See also W72-03247) (Knapp-USGS)

W72-03253

SIMULATION OF THE WATER MOVEMENT IN THE HUPSELSE BEEK WATERSHED,
Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.

J. Balek, and M. Cislerova.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 93-99, 1970. 3 fig, 7 ref.

Descriptors: *Water balance, *Mathematical models, Computer programs, Evapotranspiration, Infiltration, Soil moisture, Temperature, Precipitation (Atmospheric), Systems analysis.

Identifiers: *Guelph Water Balance Model.

The Hupselse Beek watershed, a part of the Experimental Basin of Leerink Beek in eastern Holland, was simulated using the Guelph water balance model. The drainage area measures only 6.6 sq km and the watershed surface is almost flat, covered by pastures and arable land. Only a small part of the whole area is afforested. Loam sand layers reach the depth of 2.5 m in the whole watershed. The area is drained by a network of artificial channels. Rapid exchange of water storage

and immediate reaction of the watershed are significant characteristics. Among the data used for the balance calculation are discharge, precipitation, and groundwater level, all recorded in 3-hour intervals. Maximum and minimum air temperature are recorded once a day, and soil moisture is measured once in fourteen days. Other information used includes pF curves, infiltration rates, evapotranspiration data, and potential evapotranspiration. Improvement of the subsurface phase of the model was considered necessary for further generalization of the model work. Even on a watershed of such a small size the non-uniform distribution of rainfall unfavorably influences the calculation. (See also W72-03247) (Knapp-USGS)

W72-03254

A KINEMATIC MODEL OF SURFACE RUNOFF RESPONSE,

Agricultural Research Service, Beltsville, Md. Hydrograph Lab.

D. E. Overton, and D. L. Brakesiek.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 100-112, 1970. 8 fig, 12 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Time lag, *Precipitation excess, Rainfall intensity, Routing, Linear programming, Overland flow, Hydrograph analysis, Simulation analysis, Depth-area-duration analysis.

Identifiers: Kinematic wave theory.

A kinematic model of surface runoff of a V-shaped watershed agrees well with observed runoff hydrographs. This model was formulated for an Agricultural Research Service experimental watershed. The solution of the watershed hydrograph for a steady rainfall excess rate of a long duration is shown in general dimensionalized form in terms of the physical and hydraulic characteristics of the overland flow plane and the stream channel. A sensitivity analysis shows the effects that errors in model parameters have on the computed outflow from the watershed. Storm lag time was calculated as a function of rainfall excess rate, and computed results were compared with the lumped, linear models of watershed runoff. (See also W72-03247) (Knapp-USGS)

W72-03255

REPRESENTATIVE AND EXPERIMENTAL BASINS AS DISPERSED SYSTEMS,

Agricultural Research Service, Beltsville, Md. Hydrograph Lab.

H. N. Holtan.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 112-126, 1970. 7 fig, 3 tab, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Water balance, *Mathematical models, *Routing, *Simulation analysis, Parametric hydrology, Infiltration, Evapotranspiration, Runoff, Percolation, Computer programs, Computer models, Dimensional analysis.

The lumped-system concept of watershed hydrology is particularly vulnerable to inconsistencies due to averaging. For example, a weighted average of infiltration capacities throughout a watershed may exceed a given rainfall intensity, whereas watershed outflow is produced from areas less permeable than the weighted average. An alternative concept is to treat the watershed as a dispersed system. Technical advances in physical geography are rapidly providing the dimensions required for the dispersed-system concept of watershed hydrology. Useful information is now available, in such detail that systems of grouping are required to reduce the medium of representation. In the USDA Hydrograph Laboratory's model, infil-

trated water is proportioned to evapotranspiration, downward seepage, or lateral return flow in each flow regime. Downward seepage and lateral flow are supplied by free water; hence, estimates of the seepage rate and the storage are needed in each flow regime. Groundwater recharge from the ultimate return flow regime is estimated on a regional basis. Records of average rainfall, average evapotranspiration and average stream-flow yields in the vicinity can be used to derive an average annual groundwater recharge. Flows from all subsurface regimes are converted to watershed units and added to rainfall excess as inflow for computing the channel outflow hydrograph. Details of the computation are available from the USDA Hydrograph Laboratory in the form of a computer program entitled, USDAHL-70 Model of Watershed Hydrology. (See also W72-03247) (Knapp-USGS) W72-03256

OPTIMIZATION OF A RAINFALL-RUNOFF MODEL FOR AN ARID ZONE CATCHMENT, Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.

T. G. Chapman.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 126-144, 1970. 8 fig, 8 tab, 17 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Routing, Simulation analysis, Optimization, Runoff, Parametric hydrology, Infiltration, Evapotranspiration, Arid lands, Data collections.

Identifiers: Australia.

The preliminary rainfall-runoff model proposed for the Australian representative basins program was tested with data from a small catchment in the Alice Springs area. The catchment parameters were estimated from available descriptive information and were optimized to achieve the best fit of estimated to observed storm runoff. Studies were made of the effects of using different error functions as the criterion of goodness of fit, different time intervals for model operation, bias in the estimation of observed runoff, and errors due to spatial variations in rainfall. The basic instrumentation records accumulated rainfall and stream water level at 6-minute intervals. This is supplemented by three peak water-level gages in the outlet reach. Estimates of potential evapotranspiration are also required. The model simulates the water transport processes on a catchment, to produce an estimated rainfall excess which may then be routed to the catchment outlet. The model is robust in regard to changes in the error function of differences between estimated and observed runoff, and behaves in accordance with concepts in regard to variations in model time interval and bias in observed runoff. The error remaining can be largely attributed to spatial variations in rainfall. (See also W72-03247) (Knapp-USGS) W72-03257

BOUGHTON'S DAILY RAINFALL-RUNOFF MODEL MODIFIED FOR THE BRENG CATCHMENT, D. L. Murray.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 144-161, 1970. 7 fig, 3 tab, 16 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Routing, Infiltration, Evapotranspiration, Water storage, Simulation analysis, Optimization, Parametric hydrology, Interception, Hydrographs, Base flow, Water balance.

Identifiers: *Brenig catchment (Wales).

A daily rainfall runoff model of the 20.0 sq km Brenig Catchment in North Wales represents the hydrologic processes of water passing through four primary stores: interception, upper soil, lower soil and groundwater. Fourteen parameters in the model are adjusted by an automatic technique to their optimum position. In a split-record test, computed and observed daily flows can be optimized for one year and tested for another. Matching indices are used as the criteria of fit. (See also W72-03247) (Knapp-USGS) W72-03258

PRELIMINARY SURFACE WATER RESOURCE PREDICTION IN THE UPPER TAIERI RIVER BASIN,

Ministry of Works, Dunedin (New Zealand). Water and Soil Div.

I. Simmers.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 162-183, 1970. 7 fig, 8 tab, 17 ref.

Descriptors: *Rainfall-runoff relationships, *Data collections, *Data processing, *Variability, *Rainfall disposition, Recession curves, Hydrograph analysis, Hydrographs, Water yield, Water balance.

Identifiers: Representative watersheds, New Zealand.

From a meagre historical record of flow and precipitation, basic discharge, precipitation and temperature data are synthesized by standard methods for an extended period from a recently enlarged data collection network in a 285 square mile area comprising the headwaters of the Taieri River, Otago, New Zealand, on a whole sub-catchment basis. Three distinct hydrological sub-catchments can be distinguished within the whole basin, with zones ranging from moisture excess to potential deficiency. Significant differences between sub-catchments become apparent on further analysis of respective master recession curves and mean annual frequency distributions and are demonstrated using recession constants, percentile yields and variability indices. These differences reflect the varying contributions of catchment storage and ground-water outflow on the annual surface flow characteristics. Differences exist within a geologically and pedologically homogeneous area because of varying areal precipitation, catchment storage and groundwater contribution. A lack of caution in using representative basin data for untested extrapolation in space within a region can lead to gross errors in a regional water resource assessment. (See also W72-03247) (Knapp-USGS) W72-03259

THE USE OF PRINCIPAL COMPONENT FACTOR ANALYSIS TO ESTABLISH THE UNIFORMITY OF A HYDROLOGICAL REGION IN NORTHLAND, NEW ZEALAND,

Ministry of Works, Water and Soil Div. Wellington (New Zealand).

G. J. Blake, A. D. Cook, and D. H. Greenall.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 183-200, 1970. 2 fig, 4 tab, 15 ref, append.

Descriptors: *Rainfall-runoff relationships, *Hydrogeology, *Regression analysis, Demonstration watersheds, Geomorphology, Vegetation effects, Small watersheds, Water yield, Variability, Statistical methods.

Identifiers: Principal factor analysis, New Zealand, Representative basins.

In the New Zealand representative basin program, 57 of the 90 hydrological regions now have operational representative basins, and another 15 are in

the planning stage. Because no one basin ever completely represents the region, a knowledge of the uniformity of the basin characteristics throughout the region is essential. By taking a number of basins in a region and adding other basins from outside the region, two models were produced. Thirty-nine characteristics in each model were studied using principal factor analysis, and important characteristics common to both models were compared to establish their pattern of distribution throughout the Hokianga region of New Zealand. New Zealand maps are inadequate for hydrological purposes, making the standard definition of characteristics difficult. Because of the extreme physiographical diversity of New Zealand, coupled with a sparse population and the considerable cost of hydrological research, the representative basin program is a sensible way of approaching the need for hydrological data. (See also W72-03247) (Knapp-USGS) W72-03260

THE ACCURACY OF ESTIMATES OF AREAL MEAN RAINFALL,

Otago Univ., Dunedin (New Zealand) Dept. of Geography.

For primary bibliographic entry see Field 02B. W72-03261

NEGATIVELY SKEWED DISTRIBUTION OF RUNOFF,

Toronto Univ. (Ontario). Dept. of Mechanical Engineering.

V. Klemes.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 219-236, 1970. 6 fig, 4 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Water storage, *Water yield, *Variability, Distribution patterns, Statistics, Statistical methods, Runoff forecasting, Simulation analysis, Mathematical models, Stochastic processes, Statistical models.

Identifiers: Statistical hydrology.

The distribution of annual runoff can be negatively skewed. Using a nonlinear reservoir as an approximate model for the basin, and simulating the annual pattern of effective precipitation by a random sequence, a negatively skewed annual runoff can result in basins with large storage capacities, even in cases where the distribution of annual precipitation is positively skewed. (See also W72-03247) (Knapp-USGS) W72-03262

ESTIMATION OF THE STATISTICAL CHARACTERISTICS OF SOME EVENTS ON THE BOUNDS OF THE INFORMATION GAINED FROM SOME OBSERVATIONS OF OTHER CORRELATED PHENOMENA,

Technical Univ. of Warsaw (Poland).

W. G. Strupczewski.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 236-246, 1970. 5 ref.

Descriptors: *Statistical methods, *Probability, *Data collections, Hydrologic data, Forecasting, Streamflow forecasting, Networks, Gaging stations, Stream gages.

Identifiers: Poland.

The statistical characteristics of an event may be determined by means of the interrelations between phenomena observed at different spatial points. The complete theory of utilizing observations of related events for estimation of hydrometeorological characteristics is reviewed. The method of supplementing missing observations data is examined critically. The planning of experimental tests con-

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Group 2A—General

cerning groups of correlated phenomena is also considered. Flow frequency curves are approximated by the equation of a three-parameter log-normal distribution. Polish hydrological stations have been in operation for different time periods, and the introduction of temporary hydrological observations is being considered. This problem was reduced to the estimation, by means of the method of maximum likelihood, of the parameters of a multivariate 'incomplete' random sample taken from a normal population. (See also W72-03247) (Knapp-USGS)
W72-03263

A MARKOV CHAIN MODEL FOR RAINFALL GENERATION,
Auckland Univ. (New Zealand). School of Engineering.
For primary bibliographic entry see Field 02B.
W72-03264

WATER BALANCE RESEARCH ON EXPERIMENTAL WATERSHEDS OF KURS' STATIONARY STATION OF THE INSTITUTE OF GEOGRAPHY OF THE ACADEMY OF SCIENCES OF THE USSR,
A. M. Green, and N. N. Dreyer.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 281-285, 1970. 4 tab.

Descriptors: *Water balance, *Consumptive use, *Evapotranspiration, *Farm management, *Cultivation, Land use, Lysimeters, Data collections, Demonstration watersheds, Rainfall-runoff relationships.
Identifiers: *USSR, *Experimental watersheds.

At the Kursk station of the Institute of Geography of the Academy of Sciences of the USSR, water balance study is a part of research on physics, chemistry and biological productivity of both natural and man-changed landscapes with particular attention being given to man-induced changes in natural processes. This trend in research is needed to learn anthropogenic factors in the development of natural environments. Water balance plots are of sizes commensurable with the slope length characteristic of the given area (300-400 m), and between 0.5 and 1 ha in area. They are located on the lands most typical of the zone. Intensive use of an area for mowing and grazing appreciably worsens the water balance structure. Compared to unmowed virgin lands, much more water is spent through surface runoff. (See also W72-03247) (Knapp-USGS)
W72-03265

RAINFALL DISPOSITION STUDIES ON SMALL PLOTS AT OOTACAMUND (INDEX),
Soil Conservation Research, Training and Demonstration Center, Ootacamund (India).
D. C. Das, B. Raghunath, and P. K. Thomas.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 296-308, 1970. 3 fig, 3 tab, 23 ref.

Descriptors: *Water balance, *Rainfall disposition, *Land use, Evapotranspiration, Rainfall-runoff relationships, Infiltration, Cultivation, Demonstration watersheds.
Identifiers: *India, *Experimental watersheds.

The portion of rainfall utilized was worked out on a weekly basis from the retention opportunity of the soil profile for a depth of 60 cm. The treatment plots were cultivated bench terrace, deteriorated grassland, natural evergreen submontane forest, and bare land. Depletion or accretion of soil moisture storage was determined by the gravimetric method from daily soil samples taken at fixed times. These soil moisture data were also used to

develop a reliable estimation of soil moisture from a precipitation-evaporation index. Cultivated bench terrace recorded the lowest retention peak, and deteriorated grassland the highest. Deteriorated grassland recorded least retention opportunity with quick and voluminous interflow along a shallower profile. On this plot only 29% of rainfall was utilized. Therefore, for quick and large water yield at critical periods, deteriorated or somewhat moderately grazed grasslands could be necessary. Natural forest with larger transpiration need, deeper percolation, greater retention, and detention storages is likely to yield less water, but it is likely to ensure a steady supply. The weekly variations in soil moisture in all the plots were far above the permanent wilting percentage values. (See also W72-03247) (Knapp-USGS)
W72-03266

CALIBRATION OF THE BRENIK CATCHMENT AND THE INITIAL EFFECTS OF AFFORESTATION,
Water Research Association, Marlow (England). Resources Group.
M. J. Green.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 329-345, 1970. 11 fig, 5 tab, 29 ref.

Descriptors: *Rainfall-runoff relationships, *Forest management, *Water yield, *Water balance, Forestry, Water yield improvement.
Identifiers: *Brenik (Wales), *Experimental watersheds.

The Brenik catchment, an area of 20.2 sq km in North Wales, has an altitude range 330 to 520 m, southerly aspect and mean slope of 2.5 deg. Between the years 1960 and 1965, 40% of the catchment was planted with Sitka spruce trees. From over 40 years of precipitation and streamflow records, a change in the streamflow/precipitation relationship was detected from 1964 onwards. A 15-year calibration period, with a mean annual precipitation of 1316 mm and streamflow of 848 mm was selected to predict mean annual flows for the years 1964 to 1968. The increase in flow was over 10% and the mean annual precipitation 1964 to 1968 was 1321 mm. (See also W72-03247) (Knapp-USGS)
W72-03267

DIFFICULT PROBLEMS ABOUT SMALL EXPERIMENTAL BASINS AND NECESSITY OF COLLECTING INFORMATION ON LARGE BASINS,
National Research Center for Disaster Prevention, Tokyo (Japan).
M. Sugawara.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 393-397, 1970. 3 fig, 1 tab.

Descriptors: *Small watersheds, *Rainfall-runoff relationships, *Water yield, Demonstration watersheds, Water balance, Distribution patterns, Rainfall disposition, Humid climates, Humid areas, Storm runoff.
Identifiers: *Representative watersheds.

Small experimental basins in stormy humid regions usually show large random fluctuation of rainfall distribution and rapid fluctuation of discharge. The smoothing effect both in area and in time of watersheds becomes small when the catchment area becomes small; therefore it is difficult to analyze the runoff structure of small basins. Generally, a large basin is a heterogeneous composite of several components which can be regarded as homogeneous. The hydrological features of large basins cannot be derived from their components without some laws or principles from research on large basins. (See also W72-03247) (Knapp-USGS)

W72-03268

RESEARCH RESULTS FROM MARMOT CREEK EXPERIMENTAL WATERSHED, ALBERTA, CANADA,
Canadian Forestry Service, Calgary (Alberta).
D. L. Golding.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 397-404, 1970. 2 tab, 15 ref.

Descriptors: *Demonstration watersheds, *Data collections, *Hydrologic data, *Instrumentation, Data processing, Rainfall-runoff relationships, Forest management, Groundwater recharge, Hydrogeology.
Identifiers: *Experimental watersheds, *Canada, Marmot Creek Experimental Watersheds.

The Alberta (Canada) Watershed Research Program is a cooperative effort on the part of eight federal and provincial agencies. Marmot Creek experimental watershed, established in 1962, is the most intensely instrumented and has the longest period of record of the basin projects in the program. The main objectives of the experimental basin are: to determine the hydrology of the basin with particular reference to the interrelation of precipitation, streamflow, and groundwater; to determine the effect of commercial timber harvest and subsequent regrowth in subalpine spruce-fir upon the hydrology of the area, and to develop methods for and to determine the effects of purposive manipulation of high-elevation, non-commercial spruce-fir forests upon water yield and regime. (See also W72-03247) (Knapp-USGS)
W72-03269

Soil Conservation Research, Training and Demonstration Center, Ootacamund (India). 06Some Results of Investigation on Hydrology of the Sub-watersheds in the Nilgiris (India).
B. Raghunath, D. C. Das, and P. K. Thomas.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 416-440, 1970. 2 fig, 11 tab, 30 ref.

Descriptors: *Rainfall-runoff relationships, *Water yield, Evapotranspiration, Water utilization, Consumptive use, Infiltration, Runoff, Statistical methods, Regression analysis.
Identifiers: *India, *Representative watersheds.

Data on hydrology from 17 catchments situated in the Nilgiris District, India were analyzed. The catchment areas range from 7.51 sq km to 334.63 sq km and the mean elevation from 900 m to 2200 m. The average annual rainfall varies from 75.9 cm to 253.7 cm and the annual runoff from 10.7 cm to 172 cm, whereas annual mean temperature varies from 14.77 deg C to 21.32 deg C. The catchments were under forests, pasture, plantations and under agricultural crops. Even though the catchments in general have fairly compact shape, moderate drainage densities and short times of concentrations, the percentages of runoff were not high. The reason is plant cover management and farming, deep soil and extensive rainfall distribution with moderate to low intensities. Rainfall alone could explain only 46-86% of variation, and 74% of annual runoff variation. Annual runoff was significantly related to catchment area. (See also W72-03247) (Knapp-USGS)
W72-03270

STUDIES IN ELEMENT BALANCES IN A SMALL CATCHMENT AT TAITA, NEW ZEALAND,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
For primary bibliographic entry see Field 02K.
W72-03271

EXPERIMENTAL CATCHMENTS AID INTERPRETATION OF A MORE EXTENSIVE FLOOD NETWORKS,

Pennsylvania State Univ., University Park. Dept. of Civil Engineering.

B. M. Reich, and L. L. Harrold.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 570-583, 1970. 9 fig, 2 tab, 13 ref. Contract FH-117429 Bur Public Roads.

Descriptors: *Peak discharge, *Statistics, *Ohio, *Small watersheds, *Rainfall-runoff relationships, Probability, Flood forecasting, Statistical methods, Frequency analysis.
Identifiers: *Extreme value analysis.

Flood peak discharge from USGS extensive network of gages catchments distributed over the State of Ohio were analyzed in light of the relationship between area and maximum annual extreme-value discharges obtained from a cluster of ARS experimental catchments near Coshocton, Ohio. Mean annual flood values for each USGS catchment, adjusted to a comparable value for a 10 sq mi catchment showed a more systematic regional trend than do flood statistics not modified for size of catchment. The slope of the Gumbel probability lines was consistent enough to warrant using these lines in predicting flood values for ungaged areas and for a variety of frequencies. Extremely high flood peaks were defined as statistical outliers and removed from the analyses. Climatic conditions that caused these outliers are defined. (See also W72-03247) (Knapp-USGS) W72-03272

FREQUENCY DISTRIBUTIONS OF MAXIMUM ANNUAL RAINFALL OF SHORT DURATIONS IN THAILAND,

Asian Inst. of Tech., Bangkok (Thailand).

For primary bibliographic entry see Field 02B.

W72-03273

BASE-FLOW RECESSIONS AS AN INDEX OF REPRESENTATIVENESS IN THE HYDROLOGICAL REGIONS OF NORTHLAND, NEW ZEALAND,

Ministry of Works, Whangarei (New Zealand).

J. R. Vaughn.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 602-613, 1970. 10 fig, 1 tab, 7 ref.

Descriptors: *Base flow, *Recession curves, *Low flow, Hydrograph analysis, Rainfall-runoff relationships, Data collections, Hydrologic data, Discharge (Water).

Identifiers: *Representative basins, *New Zealand.

Base-flow recessions for streams in five hydrological regions of Northland were used to determine the representativeness of the regional stations established as part of New Zealand's representative basin network. Catchments with only one rock type were selected, and flow data were collected during drought periods to allow a simple direct comparison of the recessions for streams in each region. The criteria used were the grouping of the recessions, the slope of the recessions, and the minimum flows. Four of the five representative basins are reasonably typical of the streams in their regions during periods of low flow. (See also W72-03247) (Knapp-USGS) W72-03274

THE TRANSFER VALUE OF INFORMATION COLLECTED ON REPRESENTATIVE BASINS,

Geological Survey, Washington, D.C.

H. C. Riggs.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 614-631, 1970. 18 fig, 2 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Gaging stations, *Hydrologic data, Data processing, Low flow, Recession curves, Hydrograph analysis, Hydrogeology, Statistical methods, Discharge (Water), Water yield.

Identifiers: *Representative watersheds.

Transfer of streamflow characteristics from gaged to ungaged sites usually is based on relations between flow characteristics and several variables describing basin and climatic characteristics. Studies of representative basins enable the particular hydrologic process to be described and thus help to identify the significant independent variables and the form of the relation. Such studies may also indicate the need for basin information that is not available on most ungaged basins; alternative methods of transferring flow characteristics may need to be developed. Some of these processes were found to be highly dependent on local conditions. For example, the low-flow characteristics of some streams are highly related to the geology and soil along the stream channel; and the effects of timber removal depend on the amount of the basin affected and the position of the affected part in the basin. As a result of studies on representative basins, several new methods of transferring mean flow, low-flow characteristics, and the effects of man-made changes in a basin were developed. Some of these methods require flow measurements at the site of transfer. Others require only such information as is usually available from maps or reports. (See also W72-03247) (Knapp-USGS) W72-03275

EXTRAPOLATION OF RESULTS ABOUT WATERLEVEL CHANGES IN FISSURED CARBONATE ROCKS,

Research Institute for Water Resources Development, Budapest (Hungary).

For primary bibliographic entry see Field 02F.

W72-03276

A NEWLY DEVELOPED GROUNDWATER LYSIMETER FOR MEASURING EVAPOTRANSPIRATION FROM DIFFERENT GROUNDWATER LEVELS IN A SMALL CATCHMENT AREA OF THE NORTH GERMAN COASTAL REGION,

Kiel Univ. (West Germany).

For primary bibliographic entry see Field 07B.

W72-03277

STUDIES OF INFILTRATION AND OVERLAND FLOW FOR NATURAL SURFACES,

Melbourne Univ., Parkville (Australia).

For primary bibliographic entry see Field 02G.

W72-03278

A RATIONAL APPROACH TO GROUNDWATER INVESTIGATIONS IN REPRESENTATIVE BASINS,

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

For primary bibliographic entry see Field 02F.

W72-03279

DIGITAL EVENT RECORDERS FOR REPRESENTATIVE AND EXPERIMENTAL BASINS,

Ministry of Works, Wellington (New Zealand).

For primary bibliographic entry see Field 07C.

W72-03280

PRECISE STUDY OF WATER BALANCE USING NEUTRON PROBES (ETUDE FINE DU

BILAN HYDRIQUE PAR UTILISATION DE LA SONDE A NEUTRONS),

Office de la Recherche Scientifique et Technique Outre-Mer, Tananarive (Madagascar). Centre de Tananarive.

P. Pourrut, and H. Camus.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 708-737, 1970. 17 fig, 4 ref.

Descriptors: *Water balance, *Nuclear moisture meters, *Soil water, *Evapotranspiration, Rainfall-runoff relationships, Infiltration, Porosity, Soil water movement.
Identifiers: *Representative watersheds.

Study of water balance on representative basins is difficult when the discharge of aquifers is not negligible in the flow at the gaging station. This is the case on representative basins of (Ivory Coast) and of the rivulet (Madagascar). On areas of several square kilometers, it was difficult to estimate with precision the variations of the total volume of water in the unsaturated zone of the soil and the actual evaporation by classical methods of measurements. The use of neutron scattering meter provides a good solution. It is possible to establish the water balance storm by storm, to estimate the influence of soil humidity on surface runoff and to estimate the actual evapotranspiration. The same methods may be used for determination of the infiltration under constant head, the potential of infiltration, the effective porosity, and the capacity retention. (See also W72-03247) (Knapp-USGS) W72-03281

SIMULATION MODELS,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

For primary bibliographic entry see Field 06A.

W72-03301

APPLICATION OF STABLE AND RADIOACTIVE ISOTOPES TO HYDROLOGY AND SEDIMENTOLOGY,

Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires; and Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

For primary bibliographic entry see Field 07B.

W72-03319

NUCLEAR TECHNIQUES APPLIED TO THE WATER CYCLE IN AGRONOMY: REVIEW AND PROSPECTS,

F. Couchat.

Available from the National Technical Information Service as A/CONF.49/P/626. \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/626, June 1971. 16 p, 6 fig, 25 ref.

Descriptors: *Radioisotopes, *Tracking techniques, *Water resources development, *Groundwater movement, *Water conservation, Soil-water-plant relationship, Moisture content, Hydrologic cycle, Evaporation, Evapotranspiration, Water vapor, Agronomy.

Identifiers: Stable isotopes, Radioactive isotopes, Mathematical equation, Experiment, Theoretical.

From recent research into nuclear techniques, radiation and isotopes, this paper attempts to show how the improvement in experimental and theoretical knowledge of the movement of water is linked with the necessary development of these techniques. After reviewing and developing certain terms in the general equation of conservation of water, an outline is given of the neutronic method applied to the measurement of moisture and some examples of its use. The complementary aspect of tensiometric measurements is described. Finally, emphasis is placed on the original contribution of stable and radioactive isotopes to the

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study of the movement of water from the soil to the plant and to the atmosphere. (Houser-ORNL)
W72-03321

2B. Precipitation

THE 1968 GRAND RIVER PROJECT-A TRIAL PROJECT IN PRECIPITATION MANAGEMENT.
South Dakota School of Mines and Technology, Rapid City. 06The 1968 Grand River Project-A Trial Project in Precipitation Management. For primary bibliographic entry see Field 03B.
W72-02968

SANTA BARBARA PYROTECHNIC SEEDING DEVICE TEST PROGRAM, 1969-70 SEASON AND 1967-70 SUMMARY (FINAL REPORT), North American Weather Consultants, Goleta, Calif.
For primary bibliographic entry see Field 03B.
W72-02969

ATMOSPHERIC CONSTITUENTS NEAR LAKE ERIE,
Atmospheric Physics and Chemistry Lab., Boulder, Colo.
For primary bibliographic entry see Field 02H.
W72-03121

AREAL PATTERNS OF RAINFALL IN A SMALL WATERSHED AS AFFECTED BY WIND AND METEOROLOGICAL CONDITIONS,
Hebrew Univ., Jerusalem (Israel).
D. Sharon.
In: Symposium on the Results of Research of Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 3-11, 1970. 4 fig, 2 tab, 8 ref.

Descriptors: *Rainfall disposition, *Distribution patterns, *Small watersheds, Topography, Winds, Isohyets, Variability, Arid lands, Rainfall-runoff relationships, International Hydrological Decade.
Identifiers: Israel, Representative watersheds.

In a small arid watershed during two rainy seasons, a persistent areal pattern was found in individual storms and in shorter durations, which causes an average increase of 40%-50% in the amount of rain reaching the channel area. In assessing the magnitude of the increase, the wind effect on the catch was taken in account. Wind speed seems to be the major factor affecting the pattern. (See also W72-03247) (Knapp-USGS)
W72-03248

THE ACCURACY OF ESTIMATES OF AREAL MEAN RAINFALL,
Otago Univ., Dunedin (New Zealand) Dept. of Geography.
P. Hutchinson.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 203-218, 1970. 8 fig, 2 tab, 13 ref, append.

Descriptors: *Rainfall, *Distribution patterns, *Rain gages, *Time series analysis, Correlation analysis, Calibrations, Variability, Data collections, Statistics, Statistical methods.
Identifiers: New Zealand.

Because data from adjacent rain gages are correlated and therefore not independent, the simple method of calculating the standard error of the mean rainfall on an area cannot be used. A method for calculating this standard error using time series analysis is presented, and examples are given from

two areas including an experimental catchment. The errors of estimating areal mean rainfall can be considerable. These errors can be reduced in large areas by installing additional gages, but in small experimental catchments it is the nature of the rain gage itself, rather than the design or density of the network, which provides the greater source of error. (See also W72-03247) (Knapp-USGS)
W72-03261

A MARKOV CHAIN MODEL FOR RAINFALL GENERATION,
Auckland Univ. (New Zealand). School of Engineering.
A. J. Raudkivi, and N. Lawgun.
In: Symposium of the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 269-278, 1970. 2 fig, 4 tab, 4 ref.

Descriptors: *Rainfall, *Markov processes, *Statistical models, Duration curves, Water yield, Frequency analysis, Depth-area-duration analysis, Meteorological data, Distribution patterns.
Identifiers: *New Zealand.

A statistical analysis of rainfall records is used to develop a model for generation of a sequence of short period rainfalls. The model is designed for use with a computer. The intervals between rainfalls are generated by sampling from a frequency distribution fitted to the historical data. By using a 1st-order Markov chain, the durations, yields and the distribution of the rainfall within the storm may be produced. Model parameters are based on the meteorological conditions of the Auckland (New Zealand) area. (See also W72-03247) (Knapp-USGS)
W72-03264

RAINFALL DISPOSITION STUDIES ON SMALL PLOTS AT OOTACAMUND (INDEX),
Soil Conservation Research, Training and Demonstration Center, Ootacamund (India).
For primary bibliographic entry see Field 02A.
W72-03266

FREQUENCY DISTRIBUTIONS OF MAXIMUM ANNUAL RAINFALL OF SHORT DURATIONS IN THAILAND,
Asian Inst. of Tech., Bangkok (Thailand).
S. Pinkayad, and C. Ertuna.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 590-602, 1970. 7 fig, 9 ref.

Descriptors: *Rainfall, *Statistics, *Humid areas, Distribution patterns, Frequency analysis, Design storm, Design flood, Precipitation (Atmospheric), Data collections, Meteorological data, Hydrologic data, Storm runoff.
Identifiers: Thailand, Representative basins.

Short period records of short duration (0.5 hr, 1.0 hr, 2.0 hrs) annual maximum rainfalls at several stations within hydrologically homogeneous regions in Thailand were combined on the basis that these data have no interstation correlations. Four frequency distributions were fitted to the combined data by the standard methods of frequency analysis. Gamma and lognormal distributions are best fitted to every duration data of all regions. Gumbel's distribution shows a fair fit and Pearson's distributions of Type I and Type III give a least fit. (See also W72-03247) (Knapp-USGS)
W72-03273

A NOTE ON THE VARIATION OF DEW AMOUNT WITH ELEVATION,
Colorado State Univ., Fort Collins. Dept. of Watershed Science.
William E. Marlatt.
Agr Meteorol. 8 (2): 151-154. Illus. 1971.

Identifiers: Animal, Dew, Ecology, Elevation, Plant.

The phenomenon of dew deposition is recognized as being of considerable significance to the plant and animal ecology of arid and semi-arid regions of the world. An excellent review article on this subject was published recently by Wallin (1967). His article, plus a brief perusal of the extensive bibliography on the subject, indicates that nearly all research on dew has been concerned with: its measurement; its role on plant development; its forecasting; and its affect on plant diseases and pests. Only a very few studies have been reported on the climatology of dew. While unfortunate, this fact is understandable and is due to a lack of standardization of instrument and measurement techniques. This report summarizes briefly the results of 3 growing seasons of dew measurements over a limited climatological network along a 340-mi. line extending across the high plains and foothills to the Continental Divide in central Colorado.—Copyright 1971, Biological Abstracts, Inc.
W72-03470

2C. Snow, Ice, and Frost

CARIBOU-POKER CREEKS RESEARCH WATERSHED, INTERIOR ALASKA, BACKGROUND AND CURRENT STATUS,
Cold Regions Research and Engineering Lab., Hanover, N. H.
For primary bibliographic entry see Field 02A.
W72-02957

THE SLIDING VELOCITY OF ATHABASCA GLACIER, CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.
W. S. B. Paterson.
Journal of Glaciology, Vol 9, No 55, p 55-63, February 1970. 2 fig, 2 tab, 21 ref.

Descriptors: *Glaciers, *Flow, *Shear, Rheology, Stress, Strain, Movement, Velocity, Topography, Friction, Melting, Slopes.
Identifiers: *Athabasca Glacier (Canada).

A method of estimating the sliding velocity of glaciers rests on a few assumptions, one of which is that longitudinal strain-rate varies linearly with depth. The flow law of ice is not required. The sliding velocity at one point must be known. The method was to calculate the sliding velocity at twelve points on Athabasca Glacier. These estimated values could not be correlated with calculated basal shear stresses. Thus one or more of the following statements must be true: (1) basal shear stress cannot be calculated by the conventional formula. (2) the roughness of the glacier bed varies from place to place, (3) Sliding velocity does not obey Weertman's formula. Analysis of seven published measurements of sliding velocity leads to the same conclusions. The assumption of uniform roughness is unlikely to be correct. Where the glacier bed was observed to be much rougher down glacier from station L27 than above that point, sliding velocities below L27 are also much smaller than they are above. (Knapp-USGS)
W72-02959

INTERNAL DEFORMATION AND THERMAL ANOMALIES IN LOWER BLUE GLACIER, MOUNT OLYMPUS, WASHINGTON, U.S.A.,
California Univ., Los Angeles. Space Science Center.
R. L. Shreve, and R. P. Sharp.
Journal of Glaciology, Vol 9, No 55, p 65-86, February 1970. 9 fig, 4 tab, 46 ref.

Descriptors: *Glaciers, *Deformation, *Flow, *Washington, *Strain measurement, Stress, Strain, Drill holes, Movement, Shear, Plasticity, Viscosity, Freezing, Melting, Temperature, Instrumentation, Surveys, Strain gages.
Identifiers: *Blue Glacier (Washington).

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Snow, Ice, and Frost—Group 2C

In 1957 through 1962 six deep holes were drilled in the Blue Glacier, Washington, by means of electrically powered hotspots. The holes were cased with 4 cm diameter aluminum pipes, and annual inclinometer surveys were made to investigate the deformation field and flow law of the ice. Although a strongly maritime climate with moderate temperatures implies that lower Blue Glacier should be temperate, freezing at depths as great as 200 m, sometimes even in summer, seriously hindered inclinometer surveys. This freezing may be due to wintertime changes of water table in the glacier and to contamination of the ice by antifreeze. Observations of pipe motion at best give only the two components of ice velocity perpendicular to the hole. Thus, a single hole gives two independent equations connecting the nine unknown derivatives of the velocity components; two holes give four equations; and three or more give at most six. Incompressibility of the ice, when applicable, gives another. The remaining unknowns must be either neglected or estimated from assumptions about the flow field. At the Blue Glacier holes the longitudinal strain-rate is less than about 0.01 per year, becoming more extensional down-glacier and more compressional at depth, because the holes were moving through a reach in which the surface steepens and the bed becomes more steep-sided and flat-bottomed. The effective strain-rates are in reasonable agreement with flow laws deduced from laboratory experiments, from tunnel contraction, and from deformation of Athabasca Glacier bore holes. The viscosities found for Blue Glacier are about half those derived from the other studies. (Knapp-USGS) W72-02960

FURTHER OBSERVATIONS ON STRESS-GENERATED ICE IN THE BLUE GLACIER, WASHINGTON, U.S.A.,
National Center for Atmospheric Research, Boulder, Colo.
C. A. Knight, and E. LaChapelle.
Journal of Glaciology, Vol. 9, No 55, p 87-101, February 1970. 13 fig, 7 ref.

Descriptors: *Ice, *Crystallography, *Stress, *Cryology, *Glaciers, Washington, Freezing, Melting, Mass transport, Melt water, Movement, Flow, Rheology, Heat flow, Stress, Strain.
Identifiers: *Blue Glacier (Wash).

Stress-generated ice crystallization features in the Blue Glacier, Washington, were studied using thin-section techniques. The crystallization features on the walls of a tunnel within the Blue Glacier are localized at fine-grained layers and are fed by liquid water traveling along grain boundaries within the wall and within the deposits themselves. The water filling a crevasse at the end of the tunnel was freezing uniformly to the crevasse walls as well as forming Thomson crystals within the water, and the evidence points to an important role for constitutional super-cooling in the Thomson crystal formation. The forms of the Thomson crystals are explainable qualitatively by heat flow effects. (Knapp-USGS) W72-02961

EXCESS PRESSURE OBSERVED IN A WATER-FILLED CAVITY IN ATHABASCA GLACIER, CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.
W. S. B. Paterson, and J. C. Savage.
Journal of Glaciology, Vol. 9, No 55, p 103-107, February 1970. 1 fig, 1 tab, 11 ref.

Descriptors: *Glaciers, *Water pressure, *Freezing, Flow, Hydrostatic pressure, Movement, Ice, Melting, Cryology, Regimen, Temperature, Pressure.
Identifiers: Athabasca Glacier (Canada).

During drilling in the Athabasca Glacier in April 1968, a cavity containing water was punctured at a depth of 9.2 m below the ice surface. Upon removing the drill, water gushed from the bore hole for

about 55 s indicating an excess pressure of a least 0.25 bar within the cavity. The surrounding ice was slightly below the pressure-melting point, and the excess pressure was apparently generated by the reduction in volume of the cavity caused by freezing of some of the water within it. (Knapp-USGS) W72-02962

INTERPRETATION OF THE ORIENTATION OF ICE DENDRITES GROWING FROM SUPER-COOLED WATER,
Consejo Nacional de Investigaciones Cientificas y Technicas, Buenos Aires (Argentina).
L. Levi.
Journal of Glaciology, Vol. 9, No 55, p 109-116, February 1970. 2 tab, 11 ref.

Descriptors: *Ice, *Cryology, *Crystallography, *Crystal growth, *Supercooling, Crystallization, Equilibrium, Freezing, Water temperature, Aqueous solutions, Growth rates.

An interpretation is purposed of the phenomenon of splitting of ice dendrites growing from super-cooled water and of their orientation to the basal plane. Both phenomena are related to the instabilities which develop on the dendritic cap when the ratio of the growth velocities in the direction of the c- and a-axes exceeds a certain limit. The different interface supercoolings and at the tip and at the sides of the dendrite cap are considered. Although the ratio of growth velocities increases with the bath supercooling, the velocity in the c-direction is much smaller than that in the a-direction through the whole range investigated. Considering the kinetic theory of the molecular growth mechanism, most of the studied interval must correspond to the transitional regime of growth. (Knapp-USGS) W72-02963

SOLUTE SEGREGATION IN ICE OBSERVED BY AUTORADIOGRAPHY,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
Y. Mizuno, and D. Kuroiwa.
Journal of Glaciology, Vol. 9, No 55, p 117-124, February 1970. 6 fig, 2 ref.

Descriptors: *Freezing, *Crystallization, *Aqueous solutions, *Tracers, *Radioactivity techniques, Radioisotopes, Crystallography, Solutes, Mass transfer.
Identifiers: Autoradiography, Solute segregation (Freezing).

Segregation of chemical impurities in ice formed from very dilute solutions was observed autoradiographically, using radioactive NaCl or HCl as Beta-ray tracers. When water containing such radioactive solutes was frozen, the segregation of solute occurred primarily along grain boundaries and partly in grains. Autoradiography of successive layers showed the heterogeneous distributions of segregated impurities in ice. (Knapp-USGS) W72-02964

LATE WEICHSELIAN POTHoles NEAR WOLVERHAMPTON, ENGLAND,
Birmingham Univ. (England). Dept. of Geology.
A. V. Morgan.
Journal of Glaciology, Vol. 9, No 55, p 125-133, February 1970. 8 fig, 19 ref.

Descriptors: *Geomorphology, *Glacial drift, *Topography, *Dating, Alluvium, Sediments, Sands, Gravels, Till, Erosion.
Identifiers: Potholes, Glaciofluvial deposits, England.

Three potholes and a narrow channel cut into bedrock in a side-hill position were observed beneath an Irish Sea till west of Wolverhampton, England. The potholes and the channel are believed to have been cut by subglacial or latero-glacial

streams flowing beneath or immediately beside the Irish Sea ice sheet. They were later choked by sand and gravel from this ice sheet and capped by till. Deposits below and above the till have been dated at 30,655 and 13,490 years B.P. at localities between 13 and 27 km north of the trench section described. (Knapp-USGS) W72-02965

GLACIER MAPS OF CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 07C.
W72-02966

A NOTE ON THE SURFACE PROFILE OF THE GREENLAND ICE SHEET,
Davos-Weissfluhjoch, Switzerland.
K. Philberth, and B. Federer.
Journal of Glaciology, Vol. 9, No 55, p 150-153, February 1970. 1 tab, 3 ref.

Descriptors: *Glaciers, *Profiles, *Movement, *Temperature, Melting, Flow, Velocity, Shear, Deformation, Water balance, Regimen.
Identifiers: *Greenland Ice Sheet.

The surface profile of the Greenland ice sheet is influenced by accumulation which increases between the ice divide and the coast, and by thermal softening of the lowermost layers. The profile can be described by Glen's law with the exponent $n = 3.5$, assuming that the bottom temperature everywhere is below the pressure melting point by a constant amount. On the basis of the measured surface profile, and not using this assumption, the maximum increase of the bottom temperature is only a few degrees within a range of 300 km. In view of the increasing surface temperature and heat of friction towards the outer edge it is concluded that, relatively close to the ice divide, the ice at the bottom must be temperate. Therefore, it is concluded that friction forces prevent the ice from slipping on the bedrock. (Knapp-USGS) W72-02967

ICE DATA COLLECTION AND USAGE: EMPHASIS ON PREDICTION TECHNIQUES,
Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
For primary bibliographic entry see Field 02H.
W72-03122

A RELATIONSHIP BETWEEN SNOW ACCUMULATION AND SNOW INTENSITY AS DETERMINED FROM VISIBILITY,
National Weather Service, Garden City, N.Y. Eastern Region.
S. E. Wasserman, and D. J. Monte.
Available from NTIS, Springfield, Va 22151, Com 71-00763, \$3.00 paper copy, 95 cents microfilm.
National Oceanic and Atmospheric Administration Memorandum NWS ER-41, May 1971. 10 p, 4 tab, 1 ref.

Descriptors: *Snowfall, *Forecasting, *Analytical techniques, *New York, Snow surveys, Precipitation gages, Weather forecasting, Snow cover.
Identifiers: Snow accumulation, Snow intensity, Visual methods.

A procedure is presented for estimating hourly snow accumulation at LaGuardia Field, N.Y., from observations of snow intensity based on visibility techniques. A relationship between reported snow intensity and estimated snowfall is shown on independent data to be reliable. Results can be applied as an aid in forecasting additional snow accumulation and in estimating previous snowfall when this information is not available from direct measurements. This technique could be developed for any other location. The development data consisted of snow intensity reports and six hourly snow depth measurements obtained during snowstorms during the months of December

Field 02—WATER CYCLE

Group 2C—Snow, Ice, and Frost

through March for the 20-year period December 1949 through March 1969. Included are only those storms in which a snow accumulation of at least 1/2 inch occurred. (Woodard-USGS)
W72-03161

THE HIGH MOUNTAIN ENVIRONMENT PROJECT, ST. ELIAS MOUNTAINS, YUKON AND ALASKA, 1967-1971.
Artic Inst. of North America, Washington, D. C.
M. G. Marcus.

Arctic Institute of North America Final Report (Research Paper No 61), June 1971. 76 p, 15 fig, 2 tab, 27 ref, append. Army Research Office Contract DAHC04-67-C-0047.

Descriptors: *Glaciers, *Alpine, *Arctic, *Ecology, *Climatology, Hydrology, Water quality, Glaciation, Mountains, Alaska, Geomorphology, Snow, Ice, Ecology, Terrestrial habitats.
Identifiers: Mt. Logan.

The results of field investigations conducted in Chitistone Pass in Alaska and on Mt. Logan in Yukon Territory, Canada, are summarized. A historical and philosophical background of the project is given, as are environmental descriptions of the research areas. During the program, research was carried out in these areas: (1) climatology and meteorology, (2) botany and plant geography, (3) periglacial hydrology and geomorphology, and (4) glaciology. Relationships between environmental processes are covered. Abstracts of published research papers and presentations that derived from the program are included, as is a listing of remaining research reports in progress. (Knapp-USGS)
W72-03171

IS THE FERRUGINATION OF MOUNTAIN-TAIGA SOILS OF THE PERMAFROST REGION OF SIBERIA SPECIFIC. (SPETSIFICHNO LI OZHELEZHENIYE GORNO-TAYEZHNYKH POCHV MERZLOTNOY OBLASTI SIBIRI).
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.

I. A. Sokolov.
Pochvovedeniye, No 4, p 22-34, April 1971. 2 fig, 3 tab, 45 ref.

Descriptors: *Soil chemistry, *Soil formation, *Iron, *Permafrost, *Frozen soils, Freezing, Frost action, Humid areas, Humid climates, Mountain forests, Podzols, Soil horizons, Soil water movement, Soil texture, Particle size, Soil temperature, Thermocline, Mineralogy, Seasonal.
Identifiers: *USSR, *Siberia, *Ferrugination, *Il-luviation, Hematite, Taigas.

The problem of frost-induced ferrugination of mountain-taiga soils of humid permafrost regions of Siberia is examined. The two processes held responsible for the accumulation of oxalate-soluble iron in the soil profile are reviewed. These are: (1) movement of iron into the upper horizons through thermal water transport during the fall-winter period; and (2) fixation of iron in the upper horizons as a result of dehydration and coagulation of colloids under the effect of freezing. The hypothesis in question is not supported by actual geographic-genetic or experimental data and is inconsistent with presently established patterns of physical and physicochemical phenomena in freezing and frozen soils. Ferrugination of these soils is the result of internal weathering and the illuvial Al-Fe humus process. The rate of soil ferrugination and the relative content of oxalate-soluble Fe203 decrease as the climate becomes more continental. (Josefson-USGS)
W72-03239

STUDY OF SNOWMELT RUNOFF PROCESS IN TWO REPRESENTATIVE WATERSHEDS WITH DIFFERENT ELEVATION RANGE.
Swiss Federal Inst. for Snow and Avalanche Research, Davos-Weissfluhjoch.
For primary bibliographic entry see Field 02A.

W72-03250

THE FIELD OF STUDY OF THE ECOLOGICAL STATION MESSAURE,

Ekologiska Stationen, Messaure (Sweden).

K. Mueller.

Oikos. Suppl. (13): 9-13. Maps. Illus. 1970.

Identifiers: Behavior, Ecological, Field, Messaure, Organisms, Rhythmic, Station, Stream, Sweden.

The field of study of the Ecological Station Messaure situated on the arctic circle in northern Sweden includes analysis of the diurnal and annual periodic rhythm in the behavior of organisms living in streams. The principal object of study is the nearby Kalltjokk river (itself a tributary of the St. Lule Alvi) and a tributary stream. The circumstances of extreme light and temperature conditions permit the study of natural physical, chemical and biological factors affecting the annual periodic cycle. The geographic location, hydrological and hydrographic data pertaining to the Kalltjokk, precipitation, water temperature, atmospheric temperature, light measurement data and the chemical analysis of its waters are given.--
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W72-03397

2D. Evaporation and Transpiration

EVAPORATION OF WATER AS RELATED TO WIND BARRIERS,

Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

S. B. Verma, and J. E. Cermak.

Available from the National Technical Information Service as PB-205 422, \$3.00 in paper copy, \$0.95 in microfiche. Colorado Environmental Resources Center, Ft. Collins, Completion Report Series No. 25, CER 71-725BV-JEC11, June 30, 1971, 211 p, 97 fig, 7 tab, 112 ref, 2 append. OWRB-015-COLO (3).

Descriptors: *Evaporation, *Mass transfer, *Moisture, *Soil erosion, *Windbreaks, Waves (Water), Humidity, Turbulence, Wind velocity, Wind erosion, Roughness (Hydraulic), Reynolds number, Boundary layers.

Identifiers: *Wind barriers, *Rough surfaces, Corrugated surfaces, Fences, Wavy boundary, Wind reduction, Wall heat flux, Field furrows, Moisture loss, Wind tunnel.

Local evaporation rates were measured from strips of saturated surfaces imbedded in wavy surfaces. Mean water vapor concentrations and mean velocity distributions were also measured over the wavy boundary. In the region far downstream of the leading wave, where the equilibrium boundary layer conditions were achieved, the average mass transfer coefficient was found to be a simple power function of the surface Reynolds number. Based on this result, the mass transfer data from this study correlated well with the mass transfer data from surfaces of various other geometries, e.g., evaporation data from water waves, evaporation data from flat plate and sublimation data from surfaces roughened with irregular pyramids and spanwise humps. Turbulence intensities and Reynolds stresses were measured over the wavy surfaces. Measurements of wall pressures and wall heat flux distributions were obtained for a series of points along the surface. Wind reduction factors were determined in the space between successive barriers. Measurements of turbulent shear stresses and mean velocity distributions along with the heat transfer rates in case of flow over equally spaced barriers has yielded valuable basic information concerning the boundary-layer flow over rough surfaces.
W72-02971

EFFECT OF LEAF PUBESCENCE ON TRANSPIRATION, PHOTOSYNTHETIC RATE AND

SEED YIELD OF THREE NEAR-ISOGONIC LINES OF SOYBEANS,

Pahlavi Univ., Shiraz (Iran). Dept. of Crop Science.

S. R. Ghorashy, J. W. Pendleton, R. L. Bernard,

and M. E. Bauer.

Crop Sci. 11 (3): 426-428. Illus. 1971.

Identifiers: Beans-D, Glycine-Max-D, Isogenic,

Leaf, Lines, Photosynthetic, Pubescence, Rate,

Seed, Soy, Transpiration, Yield.

Apparent photosynthesis (AP), transpiration (TR) and seed yield were determined under field conditions for 3 near-isogenic lines (isolines) of 'Clark' soybeans (Glycine max (L.) Merr.) differing in pubescence. AP of fully expanded leaves near the top of the plant and TR of individual plants were measured during the flowering stage. Seed yields and AP rates were not affected by pubescence but the dense pubescent isolate had lower transpiration rates than the normal or glabrous isolate.--
Copyright 1971, Biological Abstracts, Inc.
W72-02989

CONTRIBUTION TO THE STUDY OF THE ECOLOGY OF SOME FOREST SPECIES OF MOZAMBIQUE (PART II),

Mozambique Univ., Lourenco Marques.

J. F. Casimiro, and J. Santos Oliveira.

Rev. Cienc. Agron. Ser. B. 103-127. Illus. Maps. 1969.

English and French summary.

Identifiers: Albizia-Adiantifolia-D, Amblygonocarpus-Obtusangulus-D, Aridity, Burkea-Africana-D, Chlorophora-Excelsa-D, *Ecology, Erythrophloeum-Guineense-D, Evapo, Forest, Index, Mozambique, Ostryoderris-Stuhlmannii-D, Parinari-Curatelifolia-D, Pteleopsis-Myrtifolia-D, Species, Swartzia-Madagascariensis-D, Terminalia-Sericea-D, Transpiration.

A study of climatic data of Mozambique (potential evapotranspiration (Ep), the humidity index (Iu) the aridity index (Ia) the hydric index (Ih) and vegetation distribution revealed correlations. Graphs were drawn showing the distribution of 10 forest species (Albizia Adiantifolia, Amblygonocarpus obtusangulus, Burkea africana, Chlorophora excelsa, Erythrophloeum guineense, Ostryoderris stuhlmannii, Parinari curatellifolia, Pteleopsis myrtifolia, Swartzia madagascariensis and Terminalia sericea) as a function of the corresponding climatic conditions.--Copyright 1971, Biological Abstracts, Inc.
W72-02995

EFFECTS OF MOISTURE STRESS ON EVAPOTRANSPIRATION AND GROWTH OF COTTON (GOSSYPHIUM HIRSUTUM),

Ministry of Agriculture, Causeway (Rhodesia).

H. R. R. Metelerkamp, and K. E. Cackett.

Rhodesian J. Agric. Res. 8 (1): 47-55. 1970.

Identifiers: *Cotton-D, Evapo, Gossypium-Hirsutum-D, Growth, Irrigation, Moisture, Stress, Transpiration, Yield.

A detailed study of soil moisture changes and growth of cotton under different irrigation treatments was carried out to show the effects of drought during peak boll formation on cotton yield and development. Et/Eo ratio and growth decreased rapidly, regardless of treatment, after 70% of available water had been removed from the top 120 cm of soil but yield was unaffected by a short period at 100% depletion of available water. A marked reduction in yield occurred, however, when such conditions were maintained for 2 1/2 wk. Considerable regrowth and a late boll crop occurred on the stressed treatments.--Copyright 1971, Biological Abstracts, Inc.
W72-03040

CALCIUM TRANSLOCATION IN THE PEANUT (ARACHIS HYPOGAEA L.),

Clemson Univ., S.C. Dept. of Horticulture.

For primary bibliographic entry see Field 03F.

W72-03047

WATER CYCLE—Field 02

Streamflow and Runoff—Group 2E

ANALYTICAL PROCEDURES FOR EVALUATING THE INFILTRATION AND EVAPOTRANSPIRATION TERMS OF THE WATER BALANCE EQUATION,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).

For primary bibliographic entry see Field 02A.
W72-03251

A NEWLY DEVELOPED GROUNDWATER LYSIMETER FOR MEASURING EVAPOTRANSPIRATION FROM DIFFERENT GROUNDWATER LEVELS IN A SMALL CATCHMENT AREA OF THE NORTH GERMAN COASTAL REGION,

Kiel Univ. (West Germany).
For primary bibliographic entry see Field 07B.
W72-03277

PRECISE STUDY OF WATER BALANCE USING NEUTRON PROBES (ETUDE FINE DU BILAN HYDRIQUE PAR UTILISATION DE LA SONDE A NEUTRONS),

Office de la Recherche Scientifique et Technique Outre-Mer, Tananarive (Madagascar). Centre de Tananarive.

For primary bibliographic entry see Field 02A.
W72-03281

THE INFLUENCE OF A WINDBREAK ON EVAPORATION,

Israel Meteorological Service, Bet-Dagan. Agrometeorological Div.
J. Lomas, and E. Schlesinger.
Agr Meteorol. 8 (2): 107-115. Illus. 1971.
Identifiers: Evaporation, Evaporimeter, Formula, Penman, Piche-Type, Windbreak.

Data from 2 previous investigations on windbreaks are reviewed to test their influence on evaporation in areas with and without advective energy contributing to evaporation and also to check how well the actual results could be predicted by the Penman formula. It appears that this formula permits an accurate estimate of the reduction of evaporation by a windbreak and also indicates whether or not significant reductions should be expected. The use of a Piche-type evaporimeter in measuring reduction of evaporation behind windbreaks is criticized. In areas of relatively small advective energy the use of evaporation pans is recommended.—Copyright 1971, Biological Abstracts, Inc.
W72-03352

TRANSPIRATION AND WATER RELATIONS IN DIFFERENT CLIMATIC ZONES: IV. INVESTIGATIONS ON SAND PLANTS OF THE BALTIC COAST,

Otto Stocker.
Flora Morphol Geobot Oekophysiol. 159 (4): 367-409. Illus. 1970 English summary.
Identifiers: Artemisia-Campestris-Var-Sericea-D, Baltic, Climatic, Coast, Galium-Verum-D, Helichrysum-Arenarium-D, Hippophae-Rhamnoides-D, Plants, Relations, Root, Sand, Systems, Transpiration, Water, Zones.

Hippophae rhamnoides, Artemisia campestris var. sericea, Helichrysum arenarium and Galium verum are continental-subboreomericional elements of sandy steppes. The leaves of the 1st three are hairy whereas those of Galium verum are ericoid. The absolute and relative transpiration values of all 4 spp. are high. This is also true for dry periods. The curves of the daily transpiration are symmetrical with 1 peak or have, during dry periods, 2 peaks with a midday depression. The great stability of water balance even during dry period is characteristic for these sand plants. This is especially conspicuous in relation to the daily total transpiration and the transpiration-evaporation diagrams. The roots of Artemisia, Helichrysum and Galium reach a depth of 2.7 m and have 2 principal horizons: A lower one in a permanently wet layer and a higher one in a layer

which is sometimes dry. The osmotic values measured plasmolytically in epidermal cells of the suction roots are 5.5-8.5 atm. The suction force of the soil with a water content of 2.5% and more amounts only to 1.3-2.0 atm., while at lower water contents the suction force of the soil increases to values which the plants cannot overcome. The roots of the lower soil horizon are permanently active whereas those of the higher horizon become inactive during dry periods during which the suction roots die. Whenever this horizon becomes wet again by precipitation, new suction roots are rapidly regenerated. This double system of water supply guarantees on the one hand survival during dry periods and on the other hand makes possible optimal production with high rates of water turnover and favorable water potentials during rainy periods.—Copyright 1971, Biological Abstracts, Inc.
W72-03407

THE EFFECT OF A PROLONGED 2,4-DICHLOROPHENOXYACETIC-ACID TREATMENT ON TRANSPIRATION AND STOMATOL DISTRIBUTION IN TOMATO LEAVES,

Negev Inst. for Arid Zone Research, Beersheba (Israel).
Moshe Tal, and Dorot Imber.
Planta. 97 (2): 179-182. Illus. 1971.
Identifiers: Auxin, D, Distribution, Herbicide, Leaves, Light, Lycopersicon-Esculentum-D, Stomatal, Tomato-D, Transpiration.

The effect of 2,4-D applied during plant development on transpiration rate and distribution of stomata was studied in the wilty tomato (Lycopersicon esculentum) mutant, flacca, and the normal cultivar, 'Rheinlands Ruhm.' The rate of transpiration per unit leaf area was higher in treated than untreated leaves. Stomatal density in treated leaves did not increase; the stomates were able to open and close, and their aperture width under light was not greater than in untreated leaves. The ratio between stomata on the upper and lower leaf surfaces was higher in treated plants.—Copyright 1971, Biological Abstracts, Inc.
W72-03430

2E. Streamflow and Runoff

MACRO-TURBULENCE FROM WIND WAVES,

Tri-State College, Angola, Ind. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03091

THE SHEAR STRESS OF SEA BREEZE ON A SWASH ZONE,

Louisiana State Univ., Baton Rouge, Coastal Studies Inst.
For primary bibliographic entry see Field 08B.
W72-03092

ENERGY LOSSES UNDER WAVE ACTION,

Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03093

VARIATION OF LONGSHORE CURRENT ACROSS THE SURF ZONE,

Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 08B.
W72-03095

HORIZONTAL WATER PARTICLE VELOCITY OF FINITE AMPLITUDE WAVES,

Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03096

A SYSTEM FOR MEASURING ORBITAL VELOCITIES IN WAVES,

Pan American Petroleum Corp., Tulsa, Okla.
For primary bibliographic entry see Field 08B.
W72-03097

SHOALING OF FINITE-AMPLITUDE WAVES ON FLANE BEACHES,

Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03098

PERIODIC WAVES SHOALING IN WATERS OVER STEEPLY SLOPING BOTTOMS,

Indian Inst. of Tech., Madras. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03099

BREAKING WAVE SETUP AND DECAY ON GENTLE SLOPES,

Tetra Tech., Inc., Pasadena, Calif.
For primary bibliographic entry see Field 08B.
W72-03100

AIR ENTRAINMENT AND ENERGY DISSIPATION IN BREAKERS,

Technische Hochschule, Hanover (West Germany). Franzius-Institut fuer Grund- und Wasserbau.
For primary bibliographic entry see Field 08B.
W72-03101

PROBABILITIES OF BREAKING WAVE CHARACTERISTICS,

Tetra Tech., Inc., Pasadena, Calif.
For primary bibliographic entry see Field 08B.
W72-03102

CHARACTERISTICS OF WAVES BROKEN BY A LONGSHORE BAR,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-03103

VELOCITY FIELDS IN THE WAVE BREAKER ZONE,

Lagos Univ. (Nigeria). Faculty of Engineering.
For primary bibliographic entry see Field 08B.
W72-03104

THE DEVELOPMENT OF UNDULAR BORES WITH FRICTION,

Manitoba Univ., Winnipeg. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 08B.
W72-03105

COMPUTER MODELLING OF DIFFRACTION OF WIND WAVES,

California Univ., Berkeley.
For primary bibliographic entry see Field 08B.
W72-03106

INTERACTION BETWEEN WAVES AND CURRENTS,

Technical Univ. of Denmark, Lyngby.
For primary bibliographic entry see Field 08B.
W72-03107

EXPERIMENTS OF WAVE REFLEXION ON IMPERMEABLE SLOPES,

Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 08B.
W72-03108

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

LIMITING CONDITION FOR STANDING WAVE THEORIES BY PERTURBATION METHOD,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 08B.
W72-03109

A HIGHER ORDER THEORY FOR SYMMETRICAL GRAVITY WAVES,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03110

ANALYTICAL APPROACH ON WAVE OVERTOPPING ON LEVEES,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 08B.
W72-03111

IMPULSE WAVES GENERATED BY LANDSLIDES,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03112

WAVES GENERATED BY A PISTON-TYPE WAVEMAKER,
Army Coastal Engineering Research Center, Washington, D.C. Research Div.
For primary bibliographic entry see Field 08B.
W72-03113

PREDICTION CURVES FOR WAVES NEAR THE SOURCE OF AN IMPULSE,
Chicago Univ., Ill. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 08B.
W72-03114

HYDROLOGIC ANALYSIS, NORTH FORK ELK CREEK,
Montana State Univ., Bozeman. Water Resources Research Center.
For primary bibliographic entry see Field 07A.
W72-03145

FLOOD OF JANUARY 1969 NEAR AZUSA AND GLENDORA, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03152

TECHNIQUES AND EQUIPMENT REQUIRED FOR PRECISE STREAM GAGING IN TIDE-AFFECTED FRESH-WATER REACHES OF THE SACRAMENTO RIVER, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W72-03164

WASHING AWAY OF PHOSPHORUS AND POTASSIUM FROM AREAS DRAINED FOR FORESTRY AND TOPDRESSED AT DIFFERENT TIMES OF THE YEAR (ERI AJAN-KOHTINA ANNETTUJEN FOSFORIJA KALILANNOITTEIDEN HUUTOUTUMISESTA METSAOJITUSALUEILTA),
For primary bibliographic entry see Field 05G.
W72-03237

WATERSHED AREAS CONTRIBUTING TO RUNOFF,
Guelph Univ. (Ontario). School of Engineering.
For primary bibliographic entry see Field 02A.
W72-03249

A SYSTEMS-ENGINEERING APPROACH TO THE PROBLEM OF INFLUENCED RUNOFF IN PLAIN CATCHMENTS, BASED ON OBSERVATIONS GAINED IN THE MIRHO-GYOLCS EXPERIMENTAL AREA,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02A.
W72-03253

A KINEMATIC MODEL OF SURFACE RUNOFF RESPONSE,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W72-03255

BASE-FLOW RECESSIONS AS AN INDEX OF REPRESENTATIVENESS IN THE HYDROLOGICAL REGIONS OF NORTHLAND, NEW ZEALAND,
Ministry of Works, Whangarei (New Zealand).
For primary bibliographic entry see Field 02A.
W72-03274

ORIGIN AND DISTRIBUTION OF THE FISHES OF HARNEY BASIN, OREGON,
University of South Florida, Tampa. Dept. of Biology.
Peter A. Bisson, and Carl E. Bond.
Copeia. 1971 (2): 268-281. Illus. Map. 1971.
Identifiers: Basin, Distribution, *Fishes, Harney, *Oregon, Origin.

Recently discovered evidence suggests that the Harney Basin fish fauna originated through 2 geographically and chronologically distinct invasions from separate tributaries to the Columbia River system. Blitzen River, the hydrographically and ecologically isolated creeks, and the upland tributaries to Silves River all contain populations derived from the basin's Pleistocene connection with Malheur River of the Snake drainage. Colonization of many streams took place during periods of high precipitation; isolation has resulted from desiccating trends since the last glaciation. Stream capture has apparently facilitated a secondary invasion of fishes into Silves River from John Day River, a tributary to the Columbia, entering 218 miles from the mouth of the Columbia. This conclusion is supported by similarities between several Silves River and John Day River species, and by the restriction, within the basin, of 2 species to Silves River. Populations similar to those occurring in isolated regions of the Harney Basin also exist above the barrier falls of the south fork of John Day River, but this drainage is believed to be another disrupted fragment containing descendants of a more ancient Columbia fauna. Speculation regarding the sequence of dispersal throughout the Columbia system is aided by distributional patterns and knowledge of hydrographic history.--Copyright 1971, Biological Abstracts, Inc.
W72-03484

FAT CYCLES AND CONDITION FACTORS OF ALTAMAHA RIVER SHADS,
Georgia Univ., Sapelo Island. Marine Inst.
Richard J. Perkins, and Michael D. Dahlberg.
Ecology. 52 (2): 359-362. 1971.
Identifiers: Alosa-Mediacris, Alosa-Sapidissima, Altamaha, Condition, Cycles, Fat, Georgia, Oncorhynchus, River, *Shads.

The fat content and 'condition factor' of American shad (*Alosa sapidissima*) and hickory shad (*A. mediocris*) in the Altamaha River drainage in Georgia are analyzed. The fat content of these anadromous species ranged from 5.1 to 17.8% for American shad and from 3.0 to 12.9% for hickory shad. In contrast to Pacific salmon (*Oncorhynchus*), fat content did not decrease with distance upstream, probably because of the relatively short and easy passage. The likely decrease

in fat content with spawning was not statistically demonstrable because of the small number of spent individuals analyzed. Condition factor was not consistently related to fat content.--Copyright 1971, Biological Abstracts, Inc.
W72-03485

A DEVICE FOR DETERMINING VELOCITY OF FLOW NEAR THE SUBSTRATE,
Commonwealth Scientific and Industrial Research Organization, Redcliffe (Australia). Div. of Fisheries and Oceanography.
J. K. Brundritt.
Limnol Oceanogr. 16 (1): 120-123. Illus. 1971.
Identifiers: Determining, Device, Flow, Pressure, Sensor, Substrate, Velocity.

The design, construction, operation, and performance of a device for measuring flow in a 2-mm layer of water are described. Within the flowmeter, a ball in a variable-aperture microflowtube inserted between 2 openings of a differential-pressure sensing heat indicates flow velocities of 2-30 cm/sec in freshwater and 5-35 cm/sec in seawater.--Copyright 1971, Biological Abstracts, Inc.
W72-03497

THE FEASIBILITY OF USING CONTINUOUS DYE INJECTION FOR UNDERWATER FLOW VISUALIZATION,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
Alan M. Hale.
Limnol Oceanogr. 16 (1): 124-129. Illus. 1971.
Identifiers: Dye, Feasibility, Flow, Injection, Structure, Thermocline, Under, Visualization, Water.

The feasibility of using dye, continuously injected below water surface, for flow visualization is assessed. Qualitative assessment of ambient turbulence can be made, and with refinements in technique, quantitative assessments will be obtainable. The thermocline structure can be studied by this approach, and it may be the only approach that will lead to an understanding of certain phenomena occurring in this region.--Copyright 1971, Biological Abstracts, Inc.
W72-03498

2F. Groundwater

DEPTH TO BASE OF POTABLE WATER IN THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07C.
W72-02953

HYDROGEOLOGY OF THE NORTHERN YENISEY REGION (GIDROGEOLOGIYA YENISEYSKOGO SEVERA),
Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad (USSR).
G. D. Ginsburg.
Sbornik statey po gidrogeologii i geotermii, No 1, Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad, 1969. 136 p.

Descriptors: *Hydrogeology, *Geothermal studies, *Borehole geophysics, *Geochemistry, *Permafrost, Natural resources, Drilling, Water types, Water analysis, Water chemistry, Groundwater, Mineral water, Springs, Brines, Salinity, Rocks, Metals, Temperature, Pressure, Hydrate processes.
Identifiers: *USSR, *Siberia, *Yenisey River, *Tectonics, *Glaciology, Mineralization, Ore deposits, Nickel, Zinc, Aureoles.

This collection of 17 papers is devoted to a study of the hydrogeology and geothermal conditions of the Lower Yenisey Region, which includes the Taimyr National District, the Ust'-Yenisey artesian basin, the Anabar hydrogeological massif, the

northwest part of the Tunguska artesian basin, and the Turukhansk and Khantayka hydrogeological regions. A wide range of problems is examined. These include: (1) groundwaters of the Ust'-Yenisey Basin; (2) mineral waters of the Norilsk region; (3) brines of the Turukhansk region; (4) temperature of the perennially frozen rocks of northwest Siberia, the Middle Ob region, and the Taimyr Depression; (5) permafrost and its relation to tectonic structures in the Ust'-Yenisey Basin; (6) tectonic structures and their importance in the heat distribution of rocks in the northwest regions of the Siberian Platform; and (7) role of tectonic fracturing in the formation of taliks (thawed areas within the Permafrost) in the Talnakh and Otyabr'skoye deposits. A number of methods are given for finding the mineral and energy resources of the area, including: (1) a hydrogeochemical method of prospecting for ore deposits in the Norilsk region; (2) a hydrochemical method of searching for copper and nickel sulfide deposits in the northwest part of the Siberian Platform; and (3) a capillary-luminescence method of analyzing water-dissolved organic matter in estimating the oil and gas reserves of local structures. The concluding paper examines the formation of crystal hydrates of natural gases in the earth's interior and the possible geochemical and hydrodynamic consequences of this process. The text material is intended for use by geologists, hydrogeologists, geochemists, and glaciologists. (Josefson-USGS) W72-03063

ARTESIAN BASINS OF SOUTHERN KAZAKHSTAN (ARTEZIANSKIYE BASSSEYNY YUZHNOGO KAZAKHSTANA), Akademii Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki. U. M. Akhmedsafa, M. Sh. Batabergenova, M. K. Dzhabasov, S. Zh. Zhabarkhanov, and A. V. Solntsev. Izdatel'stvo 'Nauka', Alma-Ata, USSR, 1968. 122 p.

Descriptors: *Confined water, *Artesian wells, *Groundwater, *Groundwater basins, Groundwater recharge, Groundwater movement, Aquifers, Hydrogeology, Structural geology, Geologic formations, Geologic time, Salinity, Salts, Ions, Water quality, Chemical analysis, Sampling, Water resources, Pressure, Boreholes. Identifiers: *USSR, *Kazakhstan, *Artesian basins, Mineralization, Tectonics.

Artesian waters confined to bedrock complexes of varying lithological age in artesian basins of Southern Kazakhstan were examined in terms of their physico-geographic characteristics, regional distribution, source, movement, and discharge. Particular attention is given to establishing distribution patterns for their depths of occurrence, limits of pressure, mineralization and chemical composition. The thickness of the aquifers varies between 20 and 700 m and the depth of groundwater occurrence, between 20 and 3,000 m. Depending upon the lithological composition of the rocks, aquifer productivity varies between 0.5 and 100 liter/sec. Groundwater mineralization is generally 0.5-1.0 g/liter, and only occasionally does it reach 5-10 g/liter or more. Public groundwater resources are 3.3 trillion cu m and the rate of aquifer recharge is 3.0 billion cu m/yr or 90 cu m/sec. Basin distribution of estimated artesian-water resources is as follows: Kyzyl Kum--1.42 trillion cu m or 7 million cu m/sq km; Kopa-Ili--394 billion cu m or 20 million cu m/sq km; Muyn-Kum--744 billion cu m or 5 million cu m/sq km; Sary Su--Betpak-Dala--25 billion cu m or 0.5 million cu m/sq km; Turgay--94.5 billion cu m or 3 million cu m/sq km; and Balkhash--176 billion cu m or 2 million cu m/sq km. The highest-quality artesian waters (about 600 billion cu m) are concentrated in the artesian basins of piedmont depressions, where conditions are favorable for their extensive utilization, primarily for irrigation. (Josefson-USGS) W72-03064

GROUNDWATERS OF THE UST'-YENISEY BASIN (O PODZEMNYKH VODAKH UST'-YENISEYSKOY VPADINY), Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad (USSR). G. D. Ginsburg, G. A. Ivanova, M. Kh. Sapir, Ye. G. Bro, and Ju. V. Fedorov. In: Gidrogeologiya Yeniseyskogo severa, Sbornik statey po gidrogeologii i geotermii, No 1, Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad, p 6-23, 1969. 11 fig, 5 tab, 12 ref.

Descriptors: *Hydrogeology, *Groundwater, *Geologic formations, *Rocks, *Aquifer characteristics, Porosity, Permeability, Specific yield, Geologic time, Permafrost, Frozen ground, Natural resources, Water chemistry, Carbonates, Bicarbonates, Chlorides, Organic matter, Pressure, Temperature, Histograms. Identifiers: *USSR, *Siberia, *Yenisey River, *Mineralization, Hydrocarbons, Sodium carbonate, Bromine, Iodine.

The porosity, permeability, groundwater composition, and gas-bearing formations of Jurassic and Cretaceous deposits of the Ust'-Yenisey Basin were examined on the basis of data obtained from research drilling conducted in 1962-68. No single trend in the change of groundwater mineralization with depth or by area was established. Peak mineralization values (23 g/liter) were associated with the occurrence of Paleozoic aquifers, which extend to a depth of 200-300 m. A decrease in mineralization with an increase in depth from 300 to 800 m was presumed to be due to paleogeographic conditions in the Pliocene-Quaternary period. Sodium carbonate waters, confined to gas-bearing anticlinal structures, were associated with the destruction of hydrocarbon beds. The presence of bicarbonates was considered as a sign of oil and gas reserves. Higher bromine and iodine concentrations were found in the rocks of marine origin. A relationship was established between the iodine content and the content of organic carbon in the silt-clay rocks of both the marine and continental deposits. The discovery of high concentrations of iodine within the Rassokhinskiy ridge may indicate the presence of oil and gas reserves in the eastern part of the Ust'-Yenisey Basin. (Josefson-USGS) W72-03065

MINERAL WATERS OF THE NORILSK REGION (MINERAL'NYYE VODY NORIL'SKOGO RAYONA), Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad (USSR). V. I. Vozhov.

In: Gidrogeologiya Yeniseyskogo severa, Sbornik statey po gidrogeologii i geotermii, No 1, Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad, p 33-44, 1969. 2 fig, 12 tab, 5 ref.

Descriptors: *Hydrogeology, *Mineral water, *Water types, *Water utilization, Geologic formations, Geologic time, Water chemistry, Chemical analysis, Alkaline water, Saline water, Brines, Salinity, Sulfates, Chlorides, Sulfides, Gases, Nitrogen, Methane, Springs, Boreholes. Identifiers: *USSR, *Siberia, *Yenisey River, *Mineralization, Iodine, Bromine, Balneology, Balneotherapy.

Hydrogeological investigations were conducted in 1964-66 in the vicinity of Norilsk (Krasnoyarsk Territory) to study and classify the mineral waters of the region and to determine their formation conditions and the prospects of their utilization. The presence of three balneological groups of mineral waters was established: (1) sulfate and chloride; (2) sulfide; and (3) iodine and bromine. Four new types of mineral waters were identified and described: (1) the Talnakh sodium-sulfate, alkaline-earth water with a mineralization of about 4 g/liter; (2) the Kharayelakh weakly sulfide, iodine-bromine, sodium-chloride, alkaline-earth water with a mineralization of 13.7 g/liter; (3) the Gre-myaka bromine, nitrogen-methane, sodium-chloride, alkaline-earth water with a mineraliza-

tion of 5.8 g/liter; and (4) the Val'ka bromine, sodium- and calcium-chloride water with a mineralization of 21.6 g/liter. Although the mineral waters of the region are not presently being exploited for medicinal purposes, their use is recommended both from the economic and therapeutic standpoint. (Josefson-USGS) W72-03066

SUMMARY OF HYDRAULIC TESTING IN AND CHEMICAL ANALYSES OF WATER SAMPLES FROM DEEP EXPLORATORY HOLES IN LITTLE FISH LAKE, MONITOR, HOT CREEK, AND LITTLE SMOKY VALLEYS, NEVADA, Geological Survey, Denver, Colo. G. A. Dinwiddie, and L. J. Schroeder. Available from NTIS, Springfield, Va., 22151 - \$3.00 printed copy, \$0.95 microfiche. Geological Survey Report USGS-474-90, 1971. 70 p, 16 fig, 21 tab, 16 ref. AEC Agreement No AT (29-2)-474.

Descriptors: *Boreholes, *Hydraulic properties, *Deep wells, *Testing, Nevada, Water chemistry, Flow nets, Groundwater movement, Test procedures, Alluvium, Transmissivity, Logging (Recording), Potentiometric level, Water table, Nevada. Identifiers: Railroad Valley (Nev).

A summary is given of data obtained from hydraulic testing in deep exploratory holes in central Nevada. The testing and analyses are in support of the AEC's underground nuclear testing program. Valley fill of Quaternary and Tertiary age, volcanic rock (tuff and rhyolite) of Tertiary age, and carbonate rock (dolomite) of Paleozoic age are penetrated by boreholes that range in depth from 2,963 ft (903 m) to 7,978 ft (2,432 m). The tests were designed to determine vertical variations in head, transmissivity, hydraulic characteristics for certain lithologic zones, chemical quality of water in selected intervals of the boreholes, and, particularly, to improve ability to predict direction and velocity of groundwater movement. Water-level contours indicate the flow pattern of groundwater generally is southeastward from Little Fish Lake Valley, Hot Creek Valley, and Little Smoky Valley into Railroad Valley, but much of the flow from one valley to another is limited to narrow, interconnecting canyons containing alluvium. Chemical and spectrographic analyses are given for water samples obtained from several intervals in 11 test borings. (Lang-USGS) W72-03067

INFLUENCE OF MINERALOGY AND MICROORGANISMS ON IRON AND SULFIDE CONCENTRATIONS IN GROUNDWATER, Missouri Univ., Columbia. Dept. of Geology. For primary bibliographic entry see Field 02K. W72-03147

WATER-LEVEL CHANGES IN THE PERMIAN CAPITAN AQUIFER, EDDY AND SOUTHERN LEA COUNTIES, NEW MEXICO, Geological Survey, Albuquerque, N. Mex. For primary bibliographic entry see Field 04B. W72-03155

COLLECTIVE ADJUSTMENT OF THE PARAMETERS OF THE MATHEMATICAL MODEL OF A LARGE AQUIFER, Arizona Univ., Tucson. Hydrology and Water Resources Interdisciplinary Program. R. E. Lovell. Arizona University Technical Reports on Hydrology and Water Resources, No 4, June 1971. 87 p, 3 fig, 4 tab, 19 ref, 2 append. OWRB B-007-ARIZ (19).

Descriptors: *Groundwater movement, *Mathematical models, *Aquifers, *Systems analysis, *Computer programs, Input-output analysis, Hydrogeology, Aquifer characteristics, Water levels, Water yield, Storage coefficient, Transmissivity, Time.

Field 02—WATER CYCLE

Group 2F—Groundwater

Identifiers: *Unconfined aquifer.

The problem of evaluating the parameters of a mathematical model of an unconfined aquifer is examined with a view toward development of automated or computer-aided methods. A formulation is presented in which subjective confidence ranges for each of the model parameters are quantified and entered into an objective function as linear penalty functions. Parameters are then adjusted by a procedure which seeks to reduce the model error to acceptable limits. A digital computer model of the Tucson basin aquifer is adapted and used to illustrate the concepts and demonstrate the method. (Woodard-USGS)
W72-03167

HYDROGEOLOGIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL, WITH A CASE STUDY IN SOUTHEASTERN WISCONSIN, Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05E.
W72-03181

APPLICATION OF THE GRAVITY METHOD TO THE DETERMINATION OF HIGH-LEVEL GROUND-WATER BOUNDARIES IN THE PAHALA-PUNALUU SECTIONS OF THE KAU DISTRICT, HAWAII, Hawaii Univ., Honolulu.
R. D. Huber.
University of Hawaii, MS Thesis, September 1970. 41 p, 11 fig, 4 tab, 21 ref, 2 append. OWRR-B-015-HI (3).

Descriptors: *Underground, *Gravity, Logging, Density, Porosity, Hawaiian Islands, *Groundwater, Geological surveys.

A gravity survey of the Pahala-Punaluu sections of the Kau District has revealed several deep-seated bodies. The bodies at Pahala and the Pahala Dump-Southeast Pahala profiles are too deep to affect the water-table configuration at Pahala. The other body at Punaluu is near the surface and may affect the water-table configuration at Punaluu. This gravity survey does not negate or change any of the conclusions reported by Adams, et al., (1970) regarding the Kolea and Pahala Dump barriers.
W72-03184

INVESTIGATION OF THE USE OF CHLORIDE FROM PRECIPITATION AS A GROUND WATER TRACER, Montana Univ., Bozeman. Joint Water Resources Research Center.
M. K. Botz.
Montana Water Resources Research Center, Termination Report, (1971). 5 p, 5 ref. OWRR-A-035-MONT (1).

Descriptors: *Groundwater, *Tracers, *Hydrologic cycle, Chlorides.

The objectives of this study were to determine if chloride ions in precipitation were a suitable tracer in the hydrologic cycle and to determine if variations in the input of chloride into a watershed by precipitation could be correlated with changes in chloride concentrations in streams, springs, and wells in the watershed. The sorption and dissolution of chloride from rocks in a granitic intrusive environment was to be examined, as was the interaction of clays and chloride ions. Of particular interest was the possibility of tracing a 'pulse' of chloride ions from a precipitation event through the hydrologic system. The study indicated that tracing of chloride ions in precipitation through a small portion of a watershed is impractical. Determination of the concentration and volume of the pulse is not simple. Added to this difficulty is the interference of man via sewage effluent, road salt, etc. To relate the chloride input to the chloride output would require an extensive sampling net and a relatively undisturbed environment. The technique

thus appears to have limited application. (Holje-Montana)
W72-03187

FLUCTUATION OF WATER TABLE OF SHALLOW GROUNDWATER OF PADDY FIELDS IN THE DOWNSTREAM BASIN OF THE AYA RIVER, Kagawa Univ., Takamatsu (Japan). Faculty of Agriculture.
K. Fukuda.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 55-69, 1970. 7 fig, 4 tab, 7 ref.

Descriptors: *Water level fluctuations, *Water table, *Irrigation practices, Precipitation (Atmospheric), Irrigated land, Soil-water-plant relationships, Temperature, Water temperature.
Identifiers: Japan, Paddy fields.

Water-level fluctuations have been studied since 1964 in irrigated paddy fields in the basin of the Aya River, Japan. Water levels are measured daily in 51 domestic wells. Water levels were statistically related to height above sea level, distance from the head of the alluvial fan, water temperature, air temperature, and precipitation. (See also W72-03247) (Knapp-USGS)
W72-03252

EXTRAPOLATION OF RESULTS ABOUT WATERLEVEL CHANGES IN FISSURED CARBONATE ROCKS, Research Institute for Water Resources Development, Budapest (Hungary).
I. Sarvary.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 631-636, 1970. 5 fig.

Descriptors: *Water level fluctuations, *Withdrawal, *Mine drainage, *Aquifers, *Karst, Groundwater movement, Drawdown, Statistical methods.
Identifiers: Hungary, Carbonate aquifers.

In a large experimental area, the water-bearing formations are generally fissured rocks, chiefly different types of dolomites and limestone. The water-level fluctuates according to the annual and multi-annual periodicity of precipitation and infiltration. A relationship was found to exist between the magnitude of the water-level movement and its absolute altitude. Using a graphical correlation it was possible to separate the effect of meteorological factors from the influence of human interference (from the effect of withdrawal due to mining operations). (See also W72-03247) (Knapp-USGS)
W72-03276

A NEWLY DEVELOPED GROUNDWATER LYSIMETER FOR MEASURING EVAPOTRANSPIRATION FROM DIFFERENT GROUNDWATER LEVELS IN A SMALL CATCHMENT AREA OF THE NORTH GERMAN COASTAL REGION, Kiel Univ. (West Germany).
For primary bibliographic entry see Field 07B.
W72-03277

A RATIONAL APPROACH TO GROUNDWATER INVESTIGATIONS IN REPRESENTATIVE BASINS, Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
D. W. Lawson.
In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; Interna-

tional Association of Scientific Hydrology Publication No 96, p 652-666, 1970. 5 fig, 1 tab, 25 ref.

Descriptors: *Demonstration watersheds, *Hydrogeology, *Groundwater movement, *Water balance, Water yield, Piezometers, Hydraulic conductivity, Recharge, Discharge (Water).
Identifiers: *Representative basins, *Canada.

A rational approach to groundwater investigations in representative basins consists of three interrelated parts: a flow system analysis; a groundwater storage analysis; and an analysis of the mechanisms of groundwater recharge and discharge. The application of the approach is illustrated by an investigation of the groundwater flow systems in the crystalline rocks of the Trapping Creek Representative Basin, centrally located in the Okanagan Highland, a highly dissected plateau in the Southern Interior Plateau of British Columbia, Canada. (See also W72-03247) (Knapp-USGS)
W72-03279

METHOD TO DETERMINE THE ABSORBED DOSE OF NATURAL RADIOACTIVITY IN UNDERGROUND WATERS (IN RUSSIAN), Kiev State Univ. (USSR).
For primary bibliographic entry see Field 05B.
W72-03320

2G. Water in Soils

MOISTURE MOVEMENT IN A HORIZONTAL SOIL COLUMN UNDER THE INFLUENCE OF AN APPLIED PRESSURE, Stanford Univ., Calif. Dept of Civil Engineering.
W. Yeh.
Available from NTIS as PB-205 443, \$3.00 in paper copy, \$0.95 in microfiche. Stanford University Department of Civil Engineering Technical Report No 77, March 1967. 119 p, 47 fig, 6 tab, 71 ref, 4 append. EPA Program 16060--03/67. USPHS Research Grant WP-00246.

Descriptors: *Soil water movement, *Hydrostatic pressure, *Saturated flow, *Unsaturated flow, Statistical methods, Theoretical analysis, Model studies, Computer programs, Systems analysis, Input-output analysis, Darcys law, Capillary action, Permeability, Infiltration, Flow characteristics.
Identifiers: Flow equations, Pressure effects, Homogeneous soils.

The horizontal movement of moisture in unsaturated homogeneous soil is described by the diffusion equation for particular boundary conditions. The problem under consideration is that of horizontal moisture movement in a semi-infinite column of homogeneous soil initially at a uniform moisture content and with flow introduced under a certain applied constant pressure at one end. The soil-water system is subdivided into saturated and unsaturated zones. The liquid pore pressure in the saturated zone varies linearly with distance from the applied pressure at the soil face to the critical suction value at the interface between the saturated and unsaturated zones. A theoretical solution was obtained by combining Darcy's equation with a modified diffusion equation that accounted for the moving interface between the two zones. The nonlinear partial differential equation of diffusion is transformed to a nonlinear ordinary differential equation and a numerical procedure for its solution is presented. Simplified flow equations assuming complete saturation to the wetting front and their solutions are presented and compared with the more rigorous approach. (Woodard-USGS)
W72-02970

INFLUENCE OF HYDRAULIC PROPERTIES OF SOIL ON PRE-GERMINATION WATER AB-

SORPTION BY RAPESEED (BRASSICA NAPUS), Manitoba Univ., Winnipeg. Dept. of Soil Science. C. F. Shaykewich, and John Williams. Agron J. 63 (3): 454-457. 1971. Identifiers: Adsorption, Brassica-Napus-D, Germination, Hydraulic, Pre, Rape-D, Seed, Soil.

In all seed densities and geometries, water absorption rate was reduced with each decrease in water potential. Hydraulic conductivity had an important influence on the water adsorption process. Soil water potential at which soil hydraulic conductivity became important was dependent upon seed density and geometry and was associated with hydraulic conductivity-water content relation of the seed.—Copyright 1971, Biological Abstracts, Inc. W72-02982

ECOLOGICAL STUDIES OF THE VEGETATION OF THE SUDAN: III. THE EFFECT OF SIMULATED RAINFALL DISTRIBUTION AT DIFFERENT ISOHYETS ON THE REGENERATION OF ACACIA SENEGAL (L.) WILLD. ON CLAY AND SANDY SOILS, Khartoum Univ. (Sudan). Dept. of Botany. M. Obeid, and A. Seif El Din. J Appl Ecol. 8 (1): 203-209. Illus. 1971. Identifiers: Acacia-Senegal-D, Clay, Distribution, Ecological, Frequency, Germination, Intensity, Isohyets, Rainfall, Regeneration, Sandy, Shower, Simulated, Soils, *Sudan, *Vegetation.

Acacia senegal has been unable to regenerate successfully under low rainfall conditions in the northern part of the gum belt in the Sudan. The effect of the temporal distribution of rainfall, at different simulated isohyets in the 2 major soil types in the gum belt, on the emergence and establishment of the seed of A. senegal was investigated. In both clays and sands the germination of seed is a direct function of the amount of simulated rainfall. However, in clays, the seeds require a higher rainfall to give the same performance they show in sands. In addition, it is not only the total amount of rainfall that controls germination but the intensity and frequency of the showers are important factors in determining whether a seed will germinate or not.—Copyright 1971, Biological Abstracts, Inc. W72-03000

ECOLOGICAL STUDIES OF THE VEGETATION OF THE SUDAN: II. THE GERMINATION OF SEEDS AND ESTABLISHMENT OF SEEDLINGS OF ACACIA SENEGAL (L.) WILLD. UNDER CONTROLLED CONDITIONS IN THE SUDAN, Gum. Research Div., El Obeid (Sudan). A. Seif El Din, and M. Obeid. J Appl Ecol. 8 (1): 191-201. Illus. 1971. Identifiers: Acacia-Senegal-D, Controlled, Ecological, Germination, Insect, Millipede, Moisture, Mulch, Predation, Seedlings, Seeds, *Soil, *Sudan, Temperature, Under, Vegetation.

The germination, emergence and subsequent establishment of the seed of Acacia senegal was studied under conditions simulating the land use practices followed in the natural habitat of this species in Kordofan Province of the Sudan. A high proportion (84%) of the seed of this species is destroyed before or at the time of germination. The early stage is very vulnerable to destruction. The large insect and millipede populations which appear at the time of seed germination are among the most important factors contributing to seedling mortality. The high soil temperature and the low soil moisture that prevail during the dry season (Oct.-May) seem to play an important role in subsequent seedling mortality. The change that a seed will produce an established plant is much lower under natural conditions than on cultivated lands. In the former only 1.3% of the seed produced established plants that survived up to the 3rd rainy season, while in the latter about 4.5% of the seeds were able to do so. A thick covering of mulch in-

duces seedling mortality by preventing the germinating seed from reaching the soil surface. In open habitats mortality is affected by climatic conditions and insect predators. On the other hand, a moderate to light mulch provides better conditions for seed germination and establishment probably through conservation of soil moisture.—Copyright 1971, Biological Abstracts, Inc. W72-03001

A STUDY OF THE EFFECTS OF PLOWING DEPTH AND NITROGEN AND PHOSPHORUS FERTILIZERS ON THE YIELD OF CORN GROWN ON THE REDDISH-BROWN FOREST SOIL OF BANEASA, Institutul Agronomic, Bucharest (Rumania). S. Dimancea, and Ionica Budoi. Lucrari Stiint Inst Agron 'N Balcescu' Sera. 12: 131-141. 1969. (English, French and Russian summaries). Identifiers: Baneasa, Brown, Corn-M, Depth, Fertilizers, Forest, Grown, Nitrogen, Phosphorus, Plowing, Reddish, Romania, *Soil, Yield.

The effects of soil plowing at 25 and 35 cm depth and the supply of moderate (N64, N96) and high rates of N and K (N96P64, N128P96) to 'HD-311' hybrid corn were investigated in 1962, 1964 and 1965. There was no difference between the yields when the soil was plowed in summer at 25 or 35 cm depth and the crops were given moderate or high rates of N and P. The amount of water accumulated in the soil was not affected by the plowing depth but by the amount of rainfall during the season. Similarly, the amount of nitric N under corn was affected only by the rates of N supplied in the spring and not by the plowing depth. Because of the high amounts of assimilable N accumulated in the soil under the preceding crop and because of the P stored along the years following the application of superphosphate, the N and P supplied to corn did not increase yield.—Copyright 1971, Biological Abstracts, Inc. W72-03011

INFLUENCE OF POLYACRYLAMIDE UPON THE PHYSICAL CHARACTERISTICS OF A REDDISHBROWN FOREST SOIL UNDER CORN, Institutul Agronomic, Bucharest (Rumania). A. Dorneanu, and T. Macavei. Lucrari Stiint Inst Agron 'N Balcescu' Sera. 12: 191-199. 1969. (English, French and Russian summaries). Identifiers: *Acrylamide, Brown, Corn-M, Forest, Physical, Poly, Reddish, Soil.

A comparative trial was made with polyacrylamide and farmyard manure. Because of its high solubility and lack of toxicity, polyacrylamide may be applied along with sprinkler irrigation. Amounts of 40 t/ha of farmyard manure applied every 2 yr changed the hydro-physical characteristics of the soil. Since polyacrylamide is cheap and available, its use is suggested on irrigated soils.—Copyright 1971, Biological Abstracts, Inc. W72-03012

DUNE WATERS IN THE NETHERLANDS: II. HYDROBIOLOGICAL DATA ON PLANKTON AND CHEMISTRY IN 1963/64 FROM ZWANEEWATER, MUY, OERD AND VAN HUNENPLAK, P. Leentvaar. Biol Jaarb. 35: 228-266. Illus. 1967. English summaries. Identifiers: Chara, Chemistry, *Dune, Eurycerus-Glacialis, Eurycerus-Lamellatus, Hunenplak, Hydrobiological, Muy, Netherlands, Oerd, Plankton, Pollution, Polygonum-Amphibium-D, Potamogeton-Natans-M, Van, Zwanewater.

In the present paper the results are given of monthly samplings in 4 other dune waters taken in 1963/64: Zwanewater near Callantsoog, de Muy on the island of Texel; het Oerd on the island of Ameland and the Van Hunenplak on the island of

Terschelling. The Zwanewater was investigated by Redeke around 1900. This dune water has a large surface and is strongly colored bluegreen throughout the year by numerous filamentous bluegreen algae. O2 saturation is high with temporary supersaturations. Bottom vegetation is absent now, but in 1900 Characeae and Potamogeton sp. covered the bottom on many places. The water became more eutrophic in the course of years, probably by the presence of breeding birds. This resulted in development of numerous algae and the disappearance of Chara and Potamogeton. The water is rich in lime. The depth is less than 1 or 2 m. De Muy is located in the dunes of the Wadden Island Texel. The water is clear and there is a bottom vegetation of Chara sp. and Fontinalis antipyretica. Plankton is rich in species with many bottom forms. The water is fresh and rich in lime. The depth is less than 1 or 2 m. In the dunes of het Oerd on the Wadden Island Ameland, 2 very shallow waters are located near each other. During long lasting rains it forms one waterbody. Both waters have a dense vegetation of waterplants, with Potamogeton natans, Polygonum amphibium, mosses (Acrocladium), Characeae and many filamentous green algae. The water is rich in lime and fresh. Chloride, lime, bicarbonate and other elements differ in each water. Plankton is rich, with many bottom forms. The rare cladoceran Eurycerus glacialis occurs in one of the waters; the common eutrophic E. lamellatus occurs in both. The Van Hunenplak on the Wadden island of Terschelling is artificially made in dunes poor in lime, in 1951. It is now a fresh water, poor in lime, with a development of Sphagnum. The pH is low during a long period of the year. Its character is acid-oligotrophic and this is an exception compared to the other dune waters. Many species of fresh water but also of acid oligotrophic water are present in the plankton. The water is clear and the depth is less than 1 m. E. glacialis invaded the water in 1962. The Van Hunenplak was artificially made as a nature reserve as a substitute for the Dodemanskisten, which was changing in character due to pollution by recreation.—Copyright 1971, Biological Abstracts, Inc. W72-03019

PECULIARITIES OF GROWTH OF SCOTCH PINE IN VARIOUS HYGROTYPES (SOIL WATER REGIME TYPES) OF THE UKRAINIAN POLESIE, P. V. Litvak. Lesovod Agrolesomeliar Respub Mezhdvom Temat Nauch Sb. 15. 104-110. 1968. Translated from Ref Zh Otd Vyp Lesoved, 1969, No. 5.56.107. Identifiers: Fluctuations, Growth, Hygrotypes, Moisture, Peculiarities, *Pine-G, Polesie, Regime, Scotch, Soil, Temperature, Types, Ukrainian.

The investigations of pine growth were carried out in 52-64-yr-old pure pine stands of site class I-III under growth condition types from A2 to B4, the most typical for the Ukrainian Polesie. The periodical fluctuations of increment were related to the fluctuations of temperature and moisture. The best water regime for pine growth on sandy soils occurred under moist conditions when the groundwater level fluctuated from 20 to 140 cm from the soil surface. When draining the swamp plots of wet bor (infertile site type of pine forest) and subor (fairly infertile site type pine forest) with a sod thickness of up to 20 cm and pine stands of medium age, it was sufficient to lower the groundwater level by 20-25 cm toward the beginning of the growing season.—Copyright 1971, Biological Abstracts, Inc. W72-03025

MOVEMENT OF PRATYLENCHUS PENETRANS AND THE MOISTURE CHARACTERISTICS OF THREE ONTARIO SOILS, Department of Agriculture, Vineland Station (Ontario). Research Station. J. L. Townshend, and L. R. Webber. Nematologica. 17 (1): 47-57. Illus. 1971. French summary.

Field 02—WATER CYCLE

Group 2G—Water in Soils

Identifiers: Aeration, Moisture, Movement, Ontario, Particle, Pore, Pratylenchus-Penetrans, Size, *Soils.

The movement and survival of *P. penetrans* were studied in 3 soils, Fox loamy sand, Jeddo loam, and Vineland silt loam that had marked differences in particle-size distribution, moisture retention, aeration, and pore size. Nematodes on paper disks were placed on the surface of soil cores that had been packed to 2 bulk densities and equilibrated at 8 moisture regimes. After 7 days the cores were partitioned, the nematodes extracted and counted. At low bulk density, a percentage of 4th and adult stages moved 4 cm in Fox between 10 and 3000 cm H₂O moisture tension and in Jeddo and Vineland between 30 and 300 H₂O; a percentage of 2nd and 3rd stages moved 4 cm in Fox between 10 and 100 cm H₂O moisture tension and in Jeddo and Vineland at 30 and 100 cm H₂O. However all stages moved only an average of 2.0 cm in Fox at 10 cm H₂O moisture tension and in Jeddo and Vineland at 100 cm H₂O. At high bulk density, a smaller percentage of all stages moved 4 cm only in Fox at 30 and 100 cm H₂O moisture tension and in Jeddo at 100 cm H₂O. Moreover 4th and adult stages moved only an average of 1.0 cm in Fox, 1.3 cm in Jeddo and 0.5 cm in Vineland at 100 cm H₂O moisture tension in each soil; 2nd and 3rd stages moved an average of 1.0 cm in Fox and 0.5 cm in Jeddo at 100 cm H₂O in both soils. In Vineland 2nd and 3rd stages did not move. Eight to 12% of the soil volume was occupied by air when movement of all stages peaked in each soil. It is suggested that the relatively large sand grains in the Fox soil provided pore sizes and moisture characteristics more suitable for nematode movement.--Copyright 1971, Biological Abstracts, Inc. W72-03029

STUDIES IN DESERT MICROBIOLOGY: II. DEVELOPMENT OF BACTERIA IN THE RHIZOSPHERE AND SOIL OF ARTEMISIA MONOSPERMA, DEL. IN RELATION TO ENVIRONMENT.

Ain Shams Univ., Cairo (Egypt). Faculty of Science.

S. H. Elwan, and A. Diab.

J Bot UAR. 13 (1): 97-108. Illus. 1970. Arabic summary.

Identifiers: Actinomycetes, Artemisia-Monosperma-D, Bacteria, *Desert, Development, Environment, Extract, Inhibitor, *Microbiology, Plant, Relation, Rhizosphere, Soil, Streptomycetes.

Seasonal variations in temperature, organic matter and rainfall were reflected on the bacterial development in the rhizosphere. High rhizosphere: soil (R/S) values of bacterial counts indicate suitability for reclamation of desert soils. The rhizosphere stimulated development of total viable bacteria with simple nutritional requirements, actinomycetes (mostly Streptomycetes), acid-producing bacteria, and cellulose decomposers. Spore production was higher in soil than in rhizosphere and in summer than in spring. Acid-producers were more abundant in soil than in the rhizosphere. Punctiform bacterial colonies were dominant in the rhizosphere, and circular ones in the soil. Mucoid colonies persisted in all seasons in the rhizosphere but not in the soil. This might be correlated with drought endurance of desert plants. No phosphate-dissolving bacteria were recorded. Plant extract contained bacterial inhibitors.--Copyright 1971, Biological Abstracts, Inc. W72-03036

STUDIES IN DESERT MICROBIOLOGY: III. CERTAIN ASPECTS OF THE RHIZOSPHERE EFFECT OF RHIZOZYCTIS STRICTA DEC. IN RELATION TO ENVIRONMENT.

Ain Shams Univ., Cairo (Egypt). Faculty of Science.

S. H. Elwan, and A. Diab.

J Bot UAR. 13 (1): 109-119. Illus. 1970. Arabic summary.

Identifiers: Bacterial, *Desert, Environment, *Microbiology, Nutrition, Relation, Rhizosphere, Rhizosphere, Sporulation.

Rhizyza stricta rhizosphere stimulated total viable bacteria and cellulose decomposers in all seasons. In winter, bacteria of complex nutrition were more abundant than those of simple nutrition, both in rhizosphere and soil. In summer, about 94% of bacteria were of simple nutrition. In summer, 99.6% of bacterial cells were vegetative in the rhizosphere and sporulation was very low. Actinomycete numbers were higher in the rhizosphere than in the soil. The rhizosphere stimulated phosphate-dissolving bacteria only in summer during which the rhizosphere:soil ratios of acid-producing bacteria were highest. Punctiforms were dominant in the soil. Mucoid colonies were higher in the rhizosphere than in the soil; the rhizosphere effect showed some aspects of bacterial stimulation that might contribute to the ability of the plant to endure drought.--Copyright 1971, Biological Abstracts, Inc. W72-03037

THE INFLUENCE OF SOIL ORGANIC MATTER TYPE ON THE AVAILABLE WATER CAPACITY,

Instituto de Investigaciones Geologicas, Galicia (Spain).

Fierros F. Diaz.

An Edafol Agrobiol. 29 (3/4): 233-243. Illus. 1970. (english summary).

Identifiers: Acids, Aggregate, Available, Capacity, Formation, Fulvic, Humic, Matter, Micro, Organic, *Soil, Type.

The soils of the mor and mull humus types have a negative influence on the quantity of available water; soils of the moder type have a positive influence. The fulvic acids are positively related with the available water levels; humic acids, negatively. The increasing degree of organic matter evolution increases the available water in the soil only to a certain degree in which the proportion of humic acids is predominant. The influence of the organic matter on the available water capacity is mostly due to the formation of microaggregates of the silt size.--Copyright 1971, Biological Abstracts, Inc. W72-03038

THE INFLUENCE OF WATER ON YIELD COMPONENTS OF WHEAT,

Ministry of Agriculture, Salisbury (Rhodesia). Salisbury Research Station.

For primary bibliographic entry see Field 03F.

W72-03043

EFFECT OF SOIL WATER POTENTIAL AND BULK DENSITY ON WATER UPTAKE PATTERNS AND RESISTANCE TO FLOW OF WATER IN WHEAT PLANTS,

Saskatchewan Univ., Saskatoon. Dpt. of Soil Science.

S. J. Yang, and E. De Jong.

Can J Soil Sci. 51 (2): 211-220. Illus. 1971.

Identifiers: Bulk, Density, Flow, Mathematical, Model, Patterns, Plants, Potential, Resistance, *Soil, Uptake, *Wheat-M.

Water uptake patterns of wheat plants were studied in a growth chamber by using 2 soils packed to 3 different bulk densities. The resistances to water movement in the soil and in the plant were calculated from the mathematical model for water uptake published in the literature. When the capillary potential of the soils was near -1/3 bar, withdrawal of water by plants was relatively small and most of the water was taken from the top 25 cm of the soil column. As soil water potential decreased, water uptake increased progressively toward the lower part of the soil column. The resistance to water movement in the plant increased from the top to the bottom of the root system and increased with increasing bulk density of the soils. For wet soils, unrealistic values were obtained which could be due to the fact that the interaction between aeration and moisture uptake is not taken into account in the theoretical equations for moisture uptake.--Copyright 1971, Biological Abstracts, Inc.

W72-03044

EFFECT OF EXCESSIVE WETNESS ON THE DYNAMICS OF SESQUIOXIDES AND MOBILE PHOSPHATES IN MEADOW-BROWN PODZOLIC SOIL OF THE MARITIME TERRITORY (VLIYANIYE PEREUVLAZHNIYA NA DINAMIKU POLUTORYNYKH OKISLOV I PODVIZHNYKH FOSFATOV V LUGOVO-B UROY OPODZOLENNOY POCHVE PRIMORSKOGO KRAYA).

A. T. Gritsun, and A. D. Vasicheva.

Pochvovedeniye, No 3, p 31-40, March 1971. 6 tab, 18 ref.

Descriptors: *Soil chemistry, *Oxides, *Phosphates, *Moisture content, *Podzols, Inorganic compounds, Iron, Manganese, Calcium carbonate, Lime, Fertilizers, Soil chemical properties, Acidity, Alkalinity, Neutralization, Hydrogen ion concentration.

Identifiers: *USSR, *Maritime territory, *Meadow-brown podzolic soils, *Sesquioxides, *Superphosphates, Liming, Composting, Mineralization.

Laboratory model experiments carried out in 1967 to study the dynamics of mobile sesquioxides and mobile phosphates in soil in relation to its moisture content are described. Excessive wetness increases considerably the amount of mobile iron, manganese, and hydrochloric acid-soluble phosphates in the soil, regardless of whether the soil remains unfertilized or is supplied with superphosphate (Ps) and Ps + CaCO₃. The longer the soil remains under these conditions, the more intense the accumulation of iron and manganese. Iron and manganese accumulate at a slower rate in soil with Ps than in soil without fertilizers and with Ps + CaCO₃. During composting of an optimally wet soil without fertilizers the phosphates of the third group increase. Under the same composting conditions, acetic acid-soluble phosphates in soil fertilized with Ps and Ps + CaCO₃ are converted to phosphates of the third group, and many of them are converted to forms not extractable with 0.5 N HCl. Prolonged excessive wetness of the soil contributes to an increased mobility of soil phosphates, particularly the hydrochloric acid-soluble forms. In excessively wet and optimally wet soils the phosphates in Ps are converted to phosphates of the third group, and many of these are converted to forms not extractable with 0.5 N HCl. Liming the soil to a neutral reaction under excessively wet conditions prevents the conversion of available phosphates in Ps to nonreadily available forms. The phosphate dynamics in Meadow-Brown Podzolic soil is directly dependent on soil moisture content and on the dynamics of the mobile iron and manganese sesquioxides. (Josefson-USGS) W72-03060

PRINCIPAL HYDROPHYSICAL PROPERTIES OF IRRIGATED SOILS IN THE VAKHSH VALLEY (OSNOVNYE VODNO-FIZICHESKIYE SVOYSTVA OROSHAYEMYKH POCHV VAKHSHSKOY DOLINY),

Tadzhikskii Selskokhozyaystvennyi Institut, Dushanbe (USSR). Chair of Soil Science and Agrochemistry.

V. V. Cherbar.

Pochvovedeniye, No 3, p 87-98, March 1971. 1 fig, 6 tab, 13 ref.

Descriptors: *Soil physics, *Soil physical properties, *Irrigated land, *Sierozems, Soil profiles, Porosity, Permeability, Soil compaction, Soil texture, Soil density, Bulk density, Particle size, Capillary water, Soil water, Soil moisture, Moisture content, Field capacity, Soil management, Irrigation.

Identifiers: *USSR, Tadzhik SSR, Vakhsh Valley, Hygroscopicity, Variation coefficient.

The results of a number of determinations of various physical properties of soils in 750 profiles of irrigated Sierozems of the Vakhsh Valley of the

Tadzhik SSR are analyzed, tabulated, and graphed. The compactness, porosity, water permeability, and particle density of these soils depend on water regime, duration of irrigation, and origin and particle-size composition of the parent material. Compaction of the soils increases and porosity and water permeability decrease with an increase in length of the irrigation period. The plow and, to some extent, the subplow layers of the soil are the most rapidly and severely compacted as a result of irrigation. Some old irrigated Sierozems, mainly of a clay texture, have a very compact subplow horizon. Judging from the average compaction indices, soil-management practices in the Vakhsh Valley should be directed toward (1) maintaining an optimal compaction of the plow layer of irrigated and old irrigated Sierozems during the growing period of cotton; (2) eliminating the compact subplow horizons of old irrigated Sierozems whenever and wherever they become widespread; and (3) finding ways to minimize the deleterious effects of irrigation on the physical properties of newly irrigated lands. (Josefson-USGS)
W72-03061

STUDY OF THE DYNAMICS OF WATER IN CLAY SOILS WHICH ARE EXCESSIVELY WET AT THE SURFACE (K IZUCHENIYU DINAMIKI VLAGOZAPASOV V GLINISTYKH POCHVAKH S POVERKHNOSTNYM PEREUVLAZHNIENIEM),
I. N. Gartsman, and A. P. Moskayev.
Pochvovedeniye, No 3, p 76-87, March 1971. 4 fig, 6 tab, 14 ref.

Descriptors: *Soil physics, *Soil physical properties, *Wetting, *Moisture content, *Soil moisture, Water balance, Clays, Soil profiles, Zone of aeration, Precipitation (Atmospheric), Evaporation, Runoff, Surface runoff, Base flow, Floods, Seasonal, Freezing, Snow cover, Cores, Evaporation pans, Variability.
Identifiers: *USSR, Soviet Far East, Water exchange.

Results of the first stage of investigations of water dynamics in fine-grained soils which are excessively wet at the surface and subjected to seasonal freezing in the monsoon climate of the southern part of the Soviet Far East are discussed. The dynamics of a soil's hydrophysical properties determines the water cycle characteristics in the zone of aeration. Two important characteristics are: (1) the intensification of the water exchange with an increase in surface moisture; and (2) the temporary accumulation of surface waters in the frozen soil layers. To be representative, an estimate of water dynamics in a soil layer should be based on data obtained for several fixed vertical profiles using, for example, the neutron method of indication, or change in weights of the soil core samples in various types of evaporimeters, such as the GGI-500-50 and GGI-500-100 designed by the Leningrad State Hydrologic Institute. (Josefson-USGS)
W72-03062

RESULTS OF APPLICATION OF HEAVY WATER (D2O) BY SOVIET AND FOREIGN RESEARCHERS IN THEIR STUDY OF WATER IN PLANTS, CLAY MINERALS AND SOIL (OB OPYTE PRIMENENIYA TYAZHELOY VODY (D2O) SOVETSKIMI I ZARUBEZHNYMI ISSLEDOVATELYAMI PRI IZUCHENII VLAGI V RASTENIYAKH, GLINISTYKH MINERALAKH I POCHVE),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
For primary bibliographic entry see Field 07B.
W72-03070

WATER PERMEABILITY OF SOILS IN THE SOUTHERN PART OF THE GOLODNAYA

STEPPE (O VODOPRONITSAYEMOSTI POCHV YUGA GOLODNNOY STEPPI),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
V. Yu. Margulis, and U-So-Tin.
Pochvovedeniye, No 3, p 115-121, March 1971. 3 fig, 3 tab, 16 ref.

Descriptors: *Land reclamation, *Grasslands, *Soil physical properties, *Permeability, *Porosity, Pores, Porous media, Infiltration, Stratification, Colluvium, Sierozems, Soil profiles, Soil horizons, Leaching, Salts, Correlation analysis, Regression analysis, On-site investigations.
Identifiers: *USSR, *Golodnaya Steppe, Correlation coefficient.

On-site investigations were conducted in 1967-68 by the V.V. Dokuchayev Soil Institute to determine vertical permeability coefficients and differential porosity of Sierozems and Sierozem-Meadow soils on stratified colluvium in the southern part of the Golodnaya Steppe in Soviet Central Asia. An indirect method of determination was used to calculate the permeability coefficients of soil layers from a pore volume greater than 200 microns. The method provides fairly reliable indices from which the mean vertical permeability coefficient can be readily derived. On the basis of the data obtained, none of the soils studied had a coefficient of permeability greater than 0.3 m/day. (Josefson-USGS)
W72-03072

INFILTRATION OF WASTE WATER INTO PEAT SOIL (JATEVESIEN SUOHONIMETTYKSESTA),
For primary bibliographic entry see Field 05G.
W72-03238

IS THE FERRUGINATION OF MOUNTAIN-TAIGA SOILS OF THE PERMAFROST REGION OF SIBERIA SPECIFIC. (SPETSIFICHNO LI OZHELEZENIYE GORNO-TAYEZHNYKH POCHV MERZLOTNOY OBLASTI SIBIRI),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
For primary bibliographic entry see Field 02C.
W72-03239

PSYCHROMETRIC METHOD OF DETERMINING WATER PRESSURE (POTENTIAL) IN SOIL AND PLANTS (PSIKHROMETRICHESKIY METOD OPREDELENIYA DAVLENIYA (POTENTIALA) VLAGI V POCHVE I RASTENIYAKH),
Moscow State Univ. (USSR). Dept. of Soil Biology, and Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.
I. I. Sudnitsyn, N. A. Muromtsev, and Kong-tau Chang.
Pochvovedeniye, No 4, p 47-55, April 1971. 2 fig, 21 ref.

Descriptors: *Soil physics, *Hygrometry, *Water pressure, *Soil-water-plant relationships, Thermodynamics, Temperature, Equilibrium, Measurement, Vapor pressure, Osmotic pressure, Pore pressure, Water properties, Hygroscopic water, Soil water, Moisture content, Wilting point, Transpiration, Pine trees.
Identifiers: *USSR, *Psychrometers, *Hygrometers, *Thermostats.

The theory and technique of using a psychrometer to determine the water pressure (potential) in soil and plants are described. Total water pressure in the soil and plants and individual pressure components are associated by a functional relationship with the equilibrium relative vapor pressure, which in the range of 90-100% can be measured with a psychrometer. Owing to its simplicity, the apparatus can be used in ordinary soil-agrophysical laboratories and directly in the field. The psychrometric method can be used to determine the relationship between soil water pressure and

soil moisture content from the results of 2-3 determinations. This makes it possible to rapidly obtain approximate data on maximum hygroscopic moisture, permanent wilting moisture, and the moisture content at which the transpiration rate begins to decrease. Combined determinations of water pressure in soil and plants by the psychrometric method yield valuable information on the water regime and the water available to plants. In 8-year-old pine trees growing on sandy steppe soils of the Archde Forestry Farm, Volgograd Oblast (1968) the water pressure during wet periods was more than minus 5 atm in the upper soil horizons and less than minus 20 atm in the needles. In dry periods, water pressure in the soil dropped to minus 20 and to minus 40 atm, and in the needles to minus 50 atm. (Josefson-USGS)
W72-03240

HYDROLOGIC ROLE OF BARE FALLOW ON ORDINARY CHERNOZEM IN THE SOUTHERN PART OF THE TRANSVOLGA FOREST STEPPE (GIDROLOGICHESKAYA ROL' CHERNOGO PARA NA CHERNOZEME OBYKNOVENNOM YUZHNOY CHASTI LESOSTEPI ZAVOLZH'YA),
Kuybyshevskii Selskokhozyaistvennyi Institut, Kinel (USSR).
D. I. Burov, and V. S. Yanchurkin.
Pochvovedeniye, No 4, p 56-62, April 1971. 5 tab, 16 ref.

Descriptors: *Soil physics, *Hydrologic aspects, *Fallowing, *Chernozems, Soil physical properties, Soil water, Soil moisture, Moisture content, Water loss, Precipitation (Atmospheric), Air temperature, Seasonal, Crops, Vetch, Oats, On-site investigations.
Identifiers: *USSR, *Transvolga Region, *Fallow, Rye, Pea.

On-site investigations were conducted at the Kinel' State Agricultural Experimental Station of the Kuybyshev Agricultural Institute to study the role of bare fallow in the accumulation and retention of soil water in Ordinary Chernozem of the southern part of the Transvolga Forest Steppe and to determine the duration of its effect on the water regime of the soil. The amount of water available in bare fallow varied both by season and by year for the period under study (1968-69). When the amount of spring moisture is small (73-74% of field moisture capacity) and the summer precipitation is abundant (about 60% of the average annual amount) bare fallow accumulates water but loses it when the soil is wet in the spring (98-100% of field moisture capacity) and the precipitation in summer is low (about 30% of the average annual amount). When the percentage of spring soil moisture is high, the bare fallow, as a preceding treatment to the planting of winter rye, retains in the soil for a year (from spring to spring) an amount of water approximating field moisture capacity. The amount of water available in the bare fallow is at all times higher than that in the cropland used for pea and vetch-oat mixture. (Josefson-USGS)
W72-03241

SODIUM CARBONATE SALINIZATION OF SOILS OF THE SANZAR ALLUVIAL FAN IN THE GOLODNAYA STEPPE (O SODOVOM ZASOLENII POCHV SANZARSKOGO KONUSA VYNOSA (GOLODNAYA STEPPI)),
Central Asian State Inst. for the Design and Planning of Irrigation Structures and Rural Electric Powerplants, Tashkent (USSR).
V. V. Maslennikov.
Pochvovedeniye, No 4, p 103-112, April 1971. 2 fig, 2 tab, 15 ref.

Descriptors: *Land reclamation, *Grasslands, *Saline soils, *Salinity, *Salts, Carbonates, Bicarbonates, Sulfates, Chlorides, Sodium compounds, Sodium sulfate, Water chemistry, Chemical analysis, Groundwater, Soil types, Soil formation, Soil profiles, Humus.

Field 02—WATER CYCLE

Group 2G—Water in Soils

Identifiers: *USSR, *Uzbek SSR, *Golodnaya Steppe, *Sodium carbonate, Mineralization, Solonchization, Solonchaks, Alluvial fans.

Despite their rare occurrence in Uzbekistan, sodium carbonate salinized soils have been found in the southern part of the Golodnaya Steppe in the area of the Sanzar alluvial fan, which is one of the oldest regions of irrigated agriculture in the Republic. Soils with a sodium carbonate and sodium sulfate type of salinity form in areas where weakly and moderately mineralized groundwaters of the sodium sulfate and sulfate type wedge out. The development of solonchic processes is associated with the capillary moisture of the non-saline loam and clay loam soils and with the weakly and moderately mineralized sodium carbonate groundwaters. Because of the development here of sodium carbonate salinized soil and groundwater, the area should be considered a region of sodium carbonate and sodium sulfate salinity rather than one of sulfate salinity, as was the case earlier. Sodium carbonate salinization and solonchization call for reclamation practices different from those employed on ordinarily saline soils. In addition to the application of chemicals, these soils can be reclaimed by lowering the groundwater to a depth of more than 2 m. (Josefson-USGS) W72-03242

DETERMINATION OF THE PERMEABILITY COEFFICIENT OF PEAT SOIL (OB OPREDELENIY Koeffitsiyenta Fil'trat-SII TORFANOY POCHVY). Moskovskii Inzhenerno-Stroitelnyi Institut (USSR).

N. I. Il'in, and Ye. S. Dzekster. Pochvovedeniye, No 4, p 127-131, April 1971. 1 fig, 4 tab, 8 ref.

Descriptors: *On-site investigations, *Permeability, *Peat, Bogs, Mathematical studies, Estimating, Estimating equations, Measurement, Spatial distribution, Variability. Identifiers: *USSR, Distribution curves.

A method of selecting the necessary number of field determinations of the permeability coefficient of peat soils with a given accuracy is described. The lognormal spatial distribution of water permeability is established for undrained peat and can also be applied to drained peat. To obtain the permeability coefficient with an accuracy of plus or minus 10% and a reliability of 0.68, the number of determinations for various sections of lowland peat must be 61-136 and for upland peat 45-119. The number of measurements required can be determined from formulas of the normal distribution. The areal distribution of the determinations depends on the properties and structure of the peat in question. (Josefson-USGS) W72-03243

LYSIMETER METHOD OF DETERMINING THE PERMEABILITY COEFFICIENT OF MANTLE LOAM (LIZIMETRICHESKIY METOD OPREDELENIYA Koeffitsiyenta Fil'trat-SII POKROVNYKH SUGLINKOV). Ministerstvo Geologii, Tashkent (USSR). M. S. Alimov. Uzbekskiy Geologicheskii Zhurnal, No 2, p 66-70, 1970. 1 fig, 4 ref.

Descriptors: *On-site investigations, *Lysimeters, *Permeability, *Loam, Grasslands, Groundwater, Water table, Pressure, Potentiometric level, Piezometers, Equations. Identifiers: *USSR, Golodnaya Steppe, Monoliths.

A brief description is presented of a lysimeter method for determining the coefficient of permeability of soils. The water table at the experimental site was 2 to 3 meters below land surface. In the experiment, a monolithic structure of undisturbed material was used consisting of a two-layered sec-

tion of sand and gravel at the bottom overlain by less previous loam or loamy soil. The coefficient of permeability of the mantle loam was determined under pressure to be 0.029 m/day. The field experiments were conducted in the Golodnaya Steppe of Soviet Central Asia on an experimental plot of the 'Malik' sovkhos. (Josefson-USGS) W72-03244

ANALYTICAL PROCEDURES FOR EVALUATING THE INFILTRATION AND EVAPOTRANSPIRATION TERMS OF THE WATER BALANCE EQUATION. Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). For primary bibliographic entry see Field 02A. W72-03251

STUDIES OF INFILTRATION AND OVERLAND FLOW FOR NATURAL SURFACES. Melbourne Univ., Parkville (Australia). K. J. Langford, R. J. Mayer, and A. K. Turner. In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 645-652, 1970. 4 fig, 2 tab, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Infiltration, *Overland flow, Simulated rainfall, On-site tests, Water storage, Hysteresis.

Depression storage was measured by placing a plastic sheet over a fallow which had been finely cultivated. The water retained on the sheet is a good measure of the average depression storage. Values of 1.4 and 1.5 mm were obtained for this particular surface. Simulated rain was applied to this plastic sheet and runoff hydrographs recorded. The results are plotted in the form of a detention-storage versus discharge graph which shows the effect of rainfall intensity on the flow. The hysteresis effects between the rising and falling stages were of the order of 50%, which indicates that methods using recession curves to determine detention storage characteristics of the rising stage, and ultimately of infiltration, could be in error. A new method for measuring infiltration in the field is described and the results compared with a more conventional method. It shows sufficient promise to justify further refinement. (See also W72-03247) (Knapp-USGS) W72-03278

PRECISE STUDY OF WATER BALANCE USING NEUTRON PROBES (ETUDE FINE DU BILAN HYDRIQUE PAR UTILISATION DE LA SONDE A NEUTRONS). Office de la Recherche Scientifique et Technique Outre-Mer, Tananarive (Madagascar). Centre de Tananarive. For primary bibliographic entry see Field 02A. W72-03281

SOILS AS COMPONENTS OF ECOSYSTEMS. Oak Ridge National Lab. Tenn. Ecological Sciences Div. For primary bibliographic entry see Field 02I. W72-03342

EFFECT OF AN ASPHALT BARRIER ON SOIL WATER AND ON YIELDS AND WATER USE BY TOMATO AND CABBAGE. Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences. For primary bibliographic entry see Field 03F. W72-03420

ASPECTS OF THE MICROBIOLOGY AND OXIDATION OF WICKEN FEN SOIL. Department of Scientific and Industrial Research, Lower Hutt (New Zealand). J. D. Stout. Soil Biochem. 3 (1): 9-25. 1971.

Identifiers: Actinomycetes, Algae, Bacillus-Poly-myxa, England, Enterobacter, Fungi, Microbiology, Oxidation, Protozoa, Pseudomonas, Serratia, Soil, Wicken-Fen.

Microbial populations of 3 different layers of undrained sedge peat in Wicken Fen and of the surface layer of an adjacent cultivated garden soil developed from the peat were examined. The surface layer (0-7.5 cm) of the undrained peat had a rhizosphere population of Gram-negative bacteria, including Pseudomonas, Enterobacter and Serratia, as well as a large Bacillus population; fungi, actinomycetes and pleomorphic bacteria were less important; anaerobes constituted 9% of the total bacterial populations; and protozoan populations were low, a feature attributed in part to the presence of high Serratia populations. The subsurface layer of the sedge peat, a depth of 7.5-15 cm, had a smaller Gram-negative population; spore-forming and pleomorphic bacteria, and actinomycetes were relatively more important; and there was a slightly larger protozoan population. The deep layer (sampled at 1 m) had a reduced population. Bacillus spores forming 44% of the total bacteria populations, and anaerobes 25%; and the protozoan fauna was small. The surface layer (0-7.5 cm) of the garden soil had a more diverse microflora; algae, actinomycetes and molds were more numerous; the bacteria showed lower counts than were found in the upper peat layers (0-7.5 and 7.5-15 cm) and only 2% were anaerobes; spores formed only 3% of the count, but vegetative Bacillus cells formed the major part of the bacterial flora, Gram-negative and pleomorphic bacteria being of less importance; and the garden soil has the richest and most active protozoan fauna. Strains of Bacillus polymyxa capable of growing in a N-free medium were isolated from all the layers and appeared to constitute the principal N-fixing population of these layers, at least under anaerobic conditions. Respiratory measurements showed a very low rate of CO₂ production, generally depressed by anaerobic conditions. Only the upper undrained peat layers showed a marked response to added glucose. ¹⁴C dating of the peat profile down to the underlying clay and measurement of B concentrations indicate that there might have been a delay of some hundreds of years between the marine invasion and commencement of peat formation some 4000 yr ago; and that peat formation proceeded more rapidly during the 1st 2000 yr of this period than in the last 2000 yr. Fire and erosion, rather than microbial oxidation, appear to have been primarily responsible for the loss of the peat during the last 2 centuries. The microbial oxidation of peat declines with increasing age of the C.—Copyright 1971, Biological Abstracts, Inc. W72-03443

ADVANCE OF IRRIGATION WATER ON THE SOIL SURFACE IN RELATION TO SOIL INFILTRATION RATE: A MATHEMATICAL AND LABORATORY MODEL STUDY. Mohamed Aseed, and Don Kirkham. Iowa Agr Home Econ Exp Sta Res Bull. 565. 293-317. Illus. 1968.

Identifiers: Dimensionless, Functions, Infiltration, Irrigation, Laboratory, Mathematical, Model, Rate, Relation, Soil, Surface.

Mathematical equations describing the horizontal advance of an irrigation stream on a soil surface are derived and discussed for different types of infiltration equations corresponding to different known field conditions. Complex variable theory is applied to transform certain complicated forms of infiltration equation solutions to algebraic forms. An irrigation model having a visible Plexiglas photographic front was constructed and operated to test the theory and obtain data not covered by the theory. The model data are recorded by photography and show a good agreement between theory and experiment for both the calculated position of the 'irrigation' front on the porous media and the 'wetted' front below the surface. Dimensionless functions are developed to present the model data. For sandy soils, where capillary effects are negligible, the infiltration

equation is of the type $y \pm Kt$; where $y \pm$ the cumulative infiltration in cm^3/cm^2 ; t = the time in min; $K \pm$ the Darcy coefficient with dimensions cm/min . Dimensionless functions are developed when the infiltration equation is assumed to be $y = Et$ alpha; where y and t are defined before; $E \pm$ a coefficient with dimensions $(\text{cm}) (\text{min})^{-1}$; alpha = a dimensionless coefficient. These dimensionless functions predict the position of the advancing water on the soil surface as a function of time and also the cumulative infiltration at each position along the irrigation check. Another type of infiltration equation for certain soils is $y = At^{1/2} + Bt$; where y and t are as defined before; A = a coefficient with dimensions $(\text{cm}) (\text{min})^{-1/2}$; B = a coefficient with dimensions $(\text{cm}) (\text{min})^{-1}$. The theory also predicts the depth of infiltration of irrigation water for such soils.—Copyright 1971, Biological Abstracts, Inc. W72-03446

WATER MOVEMENT IN WELL DRAINED VOLCANIC ASH SOILS.
Hokkaido National Agricultural Experiment Station, Sapporo (Japan).
Shigechika Hayashi, and Akira Furuhashi.
Res Bull Hokkaido Nat Agr Exp Sta. 95. 21-33. Illus. 1969. In Japanese with English summary.
Identifiers: Ash, Drained, Hydraulic, Irrigation, Movement, Plowing, Potential, Soils, Suction, Volcanic.

The soil water suction during drainage was lowest in soil where loamy coarse sand and gravel were stratified under clay loam in 4 phases; the gradients of hydraulic potential between depths above the coarse sand layer were nearly unity. In other soil phases, the gradients of the upper layers remained nearly zero. When evaporation occurred, soils with shallow gravel levels were apt to be dry, because of low water conductivity from deeper layers. The deeper the depth of plowing, the higher the soil water suction under vegetation. When the accumulated value of available precipitation was over 40 mm, the soil water suction at each depth approached a constant. It increased with the accumulated net evaporation in a parabolic curve within 70 mm. Excess irrigation lowers the soil temperature.—Copyright 1971, Biological Abstracts, Inc. W72-03447

FUNDAMENTAL RESEARCHES ON PERCOLATION OF CAPILLARY SOIL WATER.
Ehime Univ., Matsuyama (Japan). Coll. of Agriculture.
Tadaharu Nakamura.
Mem Coll Agr Ehime Univ. 14 (1): 1-106. Illus. 1969. In Japanese with English summary.
Identifiers: Capillary, Flow, Fundamental, Hydraulic, Mean, Movement, Percolation, Soil, Surface, Tension, Velocity.

The relationship between equilibrium water pressure and water content of the liquid phase was influenced by both wetting and aeration. Downward percolation of water depends not only upon the degree of water saturation, but also upon the content and status of air in water. In a closed system of water-saturated soil, the water percolated well. When the air released formed a continuous cell, the water assumed a funicular percolation. In a steady, downward capillary-percolation, the water pressure (negative) and the water content were both constant. There was always a linear relationship between the discharge and the mean velocity of the water current. The velocity of water at constant discharge was always higher in capillary-percolation than in saturated-percolation. Varying the supply of water resulted in corresponding changes of amount of effective capillary water, as well as of mean velocity. In upward capillary percolation, the attainment of equilibrium between the negative pressure applied by section and the negative water pressure required a very long time, because the discharge was very small and the cross section of 'effective' capillary water was nearly zero. Water

takes an intermediate state of movement (the movement at the funicular stage) between water movement at the capillary stage (hydraulic flow) and at the film stage (surface tension).—Copyright 1971, Biological Abstracts, Inc. W72-03450

COMPARISON OF CHROMIUM 51-VERSENATE AND TRITIATED WATER MOVEMENT IN A TERMITE MOUND AND SOIL.
University Coll. of Rhodesia, Salisbury.
J. P. Watson.
Soil Sci. 111 (3): 188-191. Illus. 1971.
Identifiers: Chromium-51, Macrotermes-Goliath, Mound, Movement, Soil, Termite, Tritiated, Versenate, Water.

A mixture of the 2 radioisotopes was injected into a mound occupied by *Macrotermes goliath* and a nearby soil to compare the suitability of the isotopes for tracing water movement above the water table. Movement of the isotopes was estimated after 117 days from soil samples taken in a vertical direction at a horizontal distance of 15 cm from the injection holes. The similarity of the depth-activity graphs of the 2 isotopes indicated the reliability of chromium-51-versenate as a tracer of major movements of liquid water.—Copyright 1971, Biological Abstracts, Inc. W72-03457

A THEORY ON THE MASS TRANSPORT OF PREVIOUSLY DISTRIBUTED CHEMICALS IN A WATER SATURATED SORBING POROUS MEDIUM.
Oregon State Univ., Corvallis. Dept. of Agricultural Chemistry.
F. T. Lindstrom, and L. Boersma.
Soil Sci. 111 (3): 192-199. Illus. 1971.
Identifiers: Chemicals, Dispersive, Distributed, Equations, Mass, Mathematical, Medium, Models, Porous, Saturated, Sorbing, Theory, Transport, Water.

Soils represent porous media of interconnecting voids. Models are proposed to predict the mass transport of chemicals through such pore systems. Usually the soil is considered as a uniform medium with an average pore size, representing the pore size distribution. It is proposed that dispersive equations including a diffusion and a convection term can be improved by taking the actual pore size distribution into account. An equation for the general distribution of chemical along the column is given and several special cases are considered.—Copyright 1971, Biological Abstracts, Inc. W72-03459

2H. Lakes

SEEPAGE BENEATH HOOVER DIKE, SOUTHERN SHORE OF LAKE OKEECHOBEE, FLORIDA.
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 04A. W72-02954

BLUEGILLS DOMINATE PRODUCTION IN A MIXED POPULATION OF FISHES.
Pennsylvania State Univ., University Park.
Edwin L. Cooper, Charles C. Wagner, and George E. Krantz.
Ecology. 52 (2): 280-290. Illus. 1971.

Descriptors: *Sunfishes.
Identifiers: *Bluegills, Density, Dominate, Fishes, Mixed, Population, Production, Stock.

The effects of exploitation on growth, condition, and surplus production were measured over an 8-yr period of population of 7 spp. of warm-water fishes in a 4.05-ha lake. The lake was shallow, fertile, and moderately productive. Population estimates of individual species were made each spring

concurrently with the annual removal of 34% to 71% of the existing population. The initial stock density of all species was 48.66 g/m^2 in the spring of 1962. The optimum yield for this mixed population was calculated to be 14.56 g/m^2 per year at a stock density of 18.67 g/m^2 , with the bluegill producing most of this surplus weight. When species were considered separately, there was poor correlation between exploitation rate and wither growth or condition. The response of the entire population to thinning was more predictable, with both growth and condition related to stock density. Best growth occurred at densities near 20 g/m^2 or approximately at the level for optimum yield.—Copyright 1971, Biological Abstracts, Inc. W72-02994

FAUNA IN VEGETATION IN CARP PONDS AT GOCZALKOWICE.
Polish Academy of Sciences, Pszczyna. Hydrobiological Station.
Tadeusz Kuflikowski.
Acta Hydrobiol. 12 (4): 439-456. Illus. 1970. Polish summary.
Identifiers: *Carp, Elodea-Canadensis-M, Fauna, Glyceria-Aquatica-M, Goczalkowice, Grasses-M, Phragmites-Communis-M, Poland, Polygonum-Amphibium-D, Ponds, Vegetation.

Investigation on the fauna living in the vegetation of carp ponds at Goczalkowice were carried out in 1966. The aim was to study qualitatively, and to some extent quantitatively, the fauna living in the vegetation and to show the similarities and dissimilarities between the pond fauna and that of the Goczalkowice dam reservoir. *Elodea canadensis*, *Polygonum amphibium*, *Glyceria aquatica*, *Phragmites communis*, and communities of heterogeneous land and aquatic plants, especially the grasses forming submerged meadows were identified.—Copyright 1971, Biological Abstracts, Inc. W72-03004

PHYSICO-CHEMICAL FEATURES OF LAKE PUPUKE, AUCKLAND.
M. A. Barker.
N Z J Mar Freshwater Res. 4 (4): 406-430. Illus. Map. 1970.
Identifiers: Auckland, Ion, *Lake, *New-Zealand, Oxygen, Physicochemical, Phyto, Plankton, Pupuke, Temperature.

Lake Pupuke, situated in the North Island of New Zealand near Auckland (Latitude 36 deg 53 ft S, Longitude 174 deg 52 ft E), is a small, circular body of water (Maximum width 1.2 km, maximum depth 55 m). From Nov. 1966 to Nov. 1967 observations on its physico-chemical factors were made twice monthly. The range of temperatures in the year was 12.0-24.2 deg C at the surface and 11.3-14.5 deg C at 40 m. A thermocline formed between early Oct. and early Jan., when it became strongly developed at about 17 m and persisted until late April. Between early May and late June the stratification was breaking down and between mid July and mid Sept. the lake was isothermal. The values for light transmitted per meter through the water were high from mid Aug. to mid Dec. (53-76%/m), very low from mid Dec. until mid Feb. (23-49%/m), high in March (75%/m) and relatively constant over the winter months (53-64%/m). The amount of light transmitted depended closely on the density of phytoplankton. Changes in the depth at which a Secchi disc disappeared paralleled the light transmission values, and the mean Secchi depth was 2.2m, range 1.0-5.2 m. O₂ concentrations down to 30 m were highest at all depths from mid Nov. to early Jan. (112-134% saturation). From early Jan. to late April O₂ was strongly stratified (epilimnion 55-100% saturation, hypolimnion 24-77% saturation). During winter O₂ values gradually increased at all depths. The range of pH was 7.8-9.5 units at the surface and 7.8-8.6 units at 30 m. From early Jan. to late April pH values were strongly stratified but from mid July to mid Aug. they were nearly uniform. The range

Field 02—WATER CYCLE

Group 2H—Lakes

of alkalinity (mainly HCO_3^- ions) was 76.0-80.8 ppm CaCO_3 and values showed stratification in summer. Carbonate ion was present from early Oct. to mid June, but free CO_2 was only found in trace amounts. The range of nitrate ion concentrations was 0.05-0.31 ppm; nitrate became obviously depleted in summer. Only 1 nitrate value was significant, 0.25 ppm other nitrate values never exceeded 0.10 ppm. The concentration of ammoniacal N built up to a summer maximum of 0.95 ppm in the hypolimnion (annual range 0-0.95 ppm); values for albuminoid ammonia (0.016-1.03 ppm of nitrogen) varied with the quantity of living matter present. The annual mean for total ion concentration (3.30 meq/l) was high and the order of ions was $\text{Na}^+ > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{K}^+ \text{ and } \text{HCO}_3^- > \text{Cl}^- > \text{SO}_4^{2-}$. Such dissolved salts may have arrived as airborne particles, dissolved in rain, or as sea spray.—Copyright 1971, Biological Abstracts, Inc. W72-03009

LIMNOLOGICAL STUDIES IN BELGIUM. V. THE KRAGEWIEL IN BORNEM, Institut Royal des Sciences Naturelles de Belgique, Brussels. Ludo Van Meel. Bull Inst Roy Sci Natur Belg. 46 (1): 1-14, 1970. Identifiers: Asterionella-Formosa, Belgium, Bornem, Ceratium-Hirundinella, Kragewiel, "Limnological, Mallomonas-Acaroides, Synedra-Acus, Synura-Uvella, Trachelomonas-Volvocina.

Over the course of a year, the Kragewiel, a pond (the result of dike ruptures; its water supply consists of runoff) in Bornem (Anvers province, Belgium) was studied parallel to other studies at Vieil-Escout in Bornem. Monthly determinations were made of the concentration of various water components (alkalinity, pH, chlorides, sulfates, nitrates, nitrites, phosphates, silica, carbohydrates, organic matter, dissolved O_2 , Ca, Mg, Na, and K) which were studied with the chlorophyll concentration. The periods of O_2 deficiency and super-saturation generally corresponded to the chlorophyll concentration maximum and minimum. Study of the phytoplankton showed a Chlorophyta-Bacillario-phyceae association with rather extensive regular dominance by Asterionella formosa, Synedra acus, and representatives of other groups such as Ceratium hirundinella, Trachelomonas volvocina, Mallomonas acaroides, and Synura uvella.—Copyright 1971, Biological Abstracts, Inc. W72-03016

CYCLE OF PHYSICAL-CHEMICAL OBSERVATIONS IN THE LAKE FUSARO, Messina Univ. (Italy). Istituto di Zoologia. Giuseppe Magazzu, and Sergio Panella. Boll Pesca Piscicolt Idrobiol. 24 (2): 171-183. Illus. Map. 1969. French and English summaries. Identifiers: Chemical, Cycle, "Eutrophication, Fusaro, Italy, Lake, Naples, Oxygenation, Physical, Pollution, Salinities.

The annual lowest and highest salinities commonly observed in the last years are, respectively, 35.5‰ and 37.9‰; extreme values (32.9‰ - 41.5‰) may occur in some particular environmental condition. Water oxygenation appears sufficient at surface, but precarious at depth, especially in spring and summer time. During this period the bottom (-5 m) has a distinct zone characterized by partially or totally anoxic denser waters. The presence of noticeable quantities of nitrites and light concentrations of inorganic phosphates shows the effects of eutrophication by sewers and agricultural wastes.—Copyright 1971, Biological Abstracts, Inc. W72-03017

SELECTED ALGAE OF DAM RESERVOIRS, THE RIVER SOLA, AND CARP PONDS, Polish Academy of Sciences, Krakow. Zaklad Biologii Wod. For primary bibliographic entry see Field 05C. W72-03021

A SURVEY OF THE FRESHWATER ALGAE OF UNION COUNTY, ILLINOIS, For primary bibliographic entry see Field 05C. W72-03022

A GC METHOD FOR THE DETERMINATION OF NITROLITRIACETIC ACID IN LAKE WATER, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters. For primary bibliographic entry see Field 05A. W72-03051

PROCESSES AND HISTORY OF TERMINOS LAGOON, MEXICO, Scripps Institution of Oceanography, San Diego, Calif. F. B. Phleger, and A. Ayala-Castanares. American Association of Petroleum Geologists Bulletin, Vol 55, No 12, p 2130-2140, December 1971. 9 fig, 18 ref. NSF-19105 and NSF-3420.

Descriptors: "Lagoons, "Surface waters, "Sedimentation, "Salinity, "Mexico, Lithification, Siltation, Water circulation, Currents (Water), Gulf of Mexico, Marine animals, Marine plants, Corals, Calcium carbonate, Streams, Inflow, Geomorphology. Identifiers: "Terminos Lagoon (Mex), Forams.

There is a net flow of Gulf of Mexico high salinity water into Terminos Lagoon, Mexico through the eastern inlet, mixing with runoff from three large rivers, and a net flow of low-salinity lagoon water out through the western inlet. The average circulation is reflected in distribution patterns of salinity, sediment size distributions, forams, percent of calcium carbonate in the sediments, and water turbidity. Relatively high organic productivity is indicated by numerous large standing stocks of forams. The lagoon is on the boundary between biogenic carbonate sediments on the east and detrital river-borne sediments on the west. The modern lagoon barrier began during the Holocene on a foundation of calcilutite when sea level was at about -10 m. The seaward side of the barrier is being eroded, except on the western end, where there is deposition. The lagoon is essentially filled with sediment, and most detritus being delivered by rivers is bypassing the lagoon. It is suggested that deposits similar to those in Terminos Lagoon can be identified in ancient sediments. (Woodard-USGS) W72-03069

THE WATER-LEVEL REGIME AND ITS ROLE IN THE OPERATION OF THE KAMA RESERVOIR (UROVENNYI REZHIM I YEGO ROL' V PROTSESSAKH FORMIROVANIYA KAMSKOGO VODOKHRANILISHCHA), Perm State Univ. (USSR). Lab. of Water Management Research. For primary bibliographic entry see Field 04A. W72-03073

EFFECT OF THE KAMA RESERVOIR ON GRASSY VEGETATION IN THE HIGH WATER-TABLE ZONE (VLIYANIYE KAMSKOGO VODOKHRANILISHCHA NA TRAVYANUYU RASTITEL'NOST' ZONY PODTOPLIENIYA), Perm State Univ. (USSR). Lab. of Water Management Research. For primary bibliographic entry see Field 04A. W72-03074

DEVELOPMENT OF HIGHER AQUATIC VEGETATION IN THE KAMA RESERVOIR (FORMIROVANIYE VYSSHEY VODNOY RASTITEL'NOSTI V KAMSKOM VODOKHRANILISHCHE), Perm State Univ. (USSR). Lab. of Water Management Research. Yu. M. Matarzin, and N. B. Sorokina.

In: Voprosy formirovaniya vodokhranilishch i ikh vliyaniya na prirodu i khozyaystvo; Perm, USSR, p 64-84, 1970. 1 fig, 2 photo, 4 tab, 44 ref.

Descriptors: "Aquatic plants, "Aquatic life, "Aquatic environment, "Aquatic habitats, "Reservoirs, Reservoir operation, Lake morphometry, Lake morphology, Shores, Shallow water, Water level fluctuations, Floating plants, Submerged plants, Marsh plants, Cattails, Aquatic weeds, Pondweeds, Aquatic algae, Wild rice, Navigation. Identifiers: "USSR, Perm Oblast, Udmurt ASSR, Kama River, Kama Reservoir, Votkinsk Reservoir, Geobotany, Phragmites, Polygonum, Phytocenoses.

Observations were conducted by the Laboratory of Water Management Research of Perm State University to study the development and distribution of higher aquatic vegetation in the Kama Reservoir (Perm Oblast) during its 12th and 13th year of operation to compare and contrast the growth of phytocenoses in the reservoir with that in the Votkinsk Reservoir (Udmurt ASSR). The aquatic and coastal vegetation of the Kama Reservoir plays an insignificant role in the aquatic life of the reservoir in its present stage of operation. The growth rate of higher plants in the areas of coves and in shallow waters near island shorelines is far more intensive than in the reservoir body as a whole. In light of the positive role of higher plants in forming the aquatic life of a water body, efforts should be made to regulate the natural development of the phytocenoses. This would make it possible to replace such inferior vegetation as Polygonum amphibium, Cicutu virosa, Polygonum hydropiper, and Utricularia vulgaris with the valuable plants Phragmites, Typha, Scirpus, Typhoides arundinacea Moench and Beckmannia eruciformis Host. The three species most promising for cultivation in the region of the Nasadka reach of the reservoir are Zizania latifolia Turcz, Typhoides arundinacea Moench and Beckmannia eruciformis Host. Intensification of artificial plantings and their proper management may not only increase the fodder base of some kolchozes of the area but also create favorable conditions for improving the fishery economy and for stimulating waterfowl reproduction. W72-03075

FORMATION OF SHALLOW-WATER AREAS IN KAMA RIVER RESERVOIRS (FORMIROVANIYE MELKOVOODIY KAMSKIKH VODOKHRANILISHCH), Perm State Univ. (USSR). Lab. of Water Management Research. For primary bibliographic entry see Field 04A. W72-03076

PROBLEMS OF RESERVOIR MORPHOMETRY AND ZONATION (VOPROSY MORFOMETRII I RAYONIROVANIYA VODOKHRANILISHCH), Perm State Univ. (USSR). Lab. of Water Management Research. Yu. M. Matarzin, and I. K. Matskevich. In: Voprosy formirovaniya vodokhranilishch i ikh vliyaniya na prirodu i khozyaystvo; Perm, USSR, p 27-45, 1970. 5 fig, 3 photo, 4 tab, 41 ref.

Descriptors: "Reservoirs, "Lakes, "Lake morphology, "Lake morphometry, Reservoir operation, Reservoir storage, Dimensions, Volume, Length, Width, Areal, Depth, Deep water, Shallow water, Shores. Identifiers: "USSR, Perm Oblast, Udmurt ASSR, Kama River, Kama Reservoir, Votkinsk Reservoir, Reservoir classification, Regionalization.

Detailed data on the morphology and morphometry of large artificial bodies of water for developing a system of dividing reservoirs into classification units were based on long-term geographic and hydrologic investigations of two reservoirs on the Kama River -- the Kama Reservoir (Perm Oblast) and the Votkinsk Reservoir (Udmurt ASSR). All morphological indices (absolute

and relative) were divided into 2 groups: (1) morphometric indices of the reservoir surface, including reservoir length and width, shoreline length, degree of shoreline dissection, reservoir surface area, and areas bounded by individual depth contours; and (2) morphometric indices of volume and maximum depth. The taxonomic units suggested for subdividing reservoirs on the Kama River are pools, regions, reaches, zones, and sub-zones. (Josefson-USGS)
W72-03077

ADSORPTION OF CHLORINATED HYDROCARBON PESTICIDES BY MICROBIAL FLOC AND LAKE SEDIMENT AND ITS ECOLOGICAL IMPLICATIONS.
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
W. O. Lesniowski, P. R. Dugan, R. M. Pfister, J. I. Frey, and C. I. Randles.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N. Y., Part 2: International Association for Great Lakes Research, p 611-618, 1970. 6 fig, 18 ref.

Descriptors: *Path of pollutants, *Adsorption, *Flocculation, *Pesticides, *Bottom sediments, Lakes, Lake Erie, Great Lakes, Aquatic bacteria, Aquatic microorganisms, Chlorinated hydrocarbon pesticides.
Identifiers: *Bacterial flocs.

Of 38 aerobic bacteria isolated from Lake Erie, 14 formed flocs in at least one of six different media used. Two of these floc formers were examined for ability to accumulate aldrin from solution. Aldrin was dissolved in acetone and added to flasks containing pregrown bacterial flocs suspended in water. Flocs were shaken for various time intervals and separated from solution by centrifugation. Both were analyzed separately for presence of aldrin using gas liquid chromatography. Contemporary sediment collected from Lake Erie was examined microscopically and analyzed for pesticide content and ability to absorb aldrin. Bacterial flocs absorbed aldrin from solution giving a 625X concentration factor within 20 min, after which there was no further increase. The collected sediment behaved similarly. Floc-forming microbes settling from a water column remove pesticides and represent a natural purification process. The pesticides may then accumulate in bottom sediments and exert a toxic effect on susceptible fauna. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03115

METAL ION CONTENT OF NIAGARA RIVER WATER.
State University Coll. Buffalo, N.Y. Dept. of Chemistry.
D. T. Meloon, Jr., and R. Yalkovsky.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N. Y., Part 2: International Association for Great Lakes Research, p 683-692, 1970. 4 fig, 3 tab, 9 ref.

Descriptors: *Water quality, *Ions, *Water pollution sources, Rivers, Water chemistry, Sodium, Potassium, Calcium, Magnesium, Flame photometry, Spectrophotometry.
Identifiers: *Niagara River.

Niagara River shallow-water samples were analyzed by atomic absorption spectrophotometry and by flame photometry. Laboratory procedures were developed for analyzing sodium, potassium, calcium, and magnesium and for overcoming chemical interferences. The concentration levels found for these elements suggest the presence of industrial and municipal contamination. Sodium concentrations were in the range 10 to 30 ppm, potassium in the range 1.2 to 4 ppm, calcium in the range 30 to 60 ppm, and magnesium in the range 7.3 to 12 ppm. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)

W72-03116

WATER MASS IDENTIFICATION IN A SMALL LAKE USING CONSERVED CHEMICAL CONSTITUENTS.
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
J. D. Spain, and S. C. Andrews.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N. Y., Part 2: International Association for Great Lakes Research, p 733-743, 1970. 4 fig, 2 tab, 10 ref.

Descriptors: *Water chemistry, *Lakes, *Provenance, *Tracking techniques, Limnology, Michigan, Mixing, Chlorides, Fluorescence, Sampling, Water analysis, Variability, Tracers, Great Lakes, Tagging.
Identifiers: *Portage Lake (Mich), Water mass identification.

Portage Lake in the Upper Peninsula of Michigan derives its water from three major sources. Because of the dynamic nature and morphology of the system, direct measurement of all inputs was not possible. A technique was employed which involved estimation of the proportion of water being derived from each of three sources by the determination of two chemical constituents whose concentrations differ within the three sources. Chloride concentration and natural fluorescence were determined on water samples taken at approximately monthly intervals throughout the year at each of the three sources and from six stations in Portage Lake. The proportion of water in the Lake from each of the three sources was calculated for each time interval. The annual cycle of fluctuations was consistent with known inputs and demonstrated that natural chemical tracers can provide a valuable adjunct to direct flow measurement when systems involving multiple sources are being studied. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03117

EROSION CONTROL IN THE TORONTO AREA.

Toronto Harbor Commissioners (Ontario).
K. S. Frichbergs.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N. Y., Part 2: International Association for Great Lakes Research, p 751-755, 1970. 2 fig, 2 tab, 4 ref.

Descriptors: *Erosion control, *Harbors, *Coastal engineering, *Lake Ontario, *Shore protection, Beach erosion, Sand bars, Sand spits, Littoral drift, Waves (Water).
Identifiers: *Toronto (Ontario).

The Toronto Island, a recurved sandspit that protects the Toronto Harbor, was formed by littoral drift derived from the eroding Scarborough Bluffs nearby. Increasing stability of the Bluffs and dredging for fill and harbor entrances have combined to starve the Island. A number of protective measures appear to have given only temporary relief or compounded the problem elsewhere. In 1965 artificial construction of the present East Headland was started. The plan was to create a large new Outer Harbor and, with the same operation, protect the eroding Island. The silting at the Eastern Channel has been cut down to almost nothing; the last dredging was performed there in 1965. In addition the Island is now receiving increased protection from easterly waves. The key to the stability of the Headland against waves is the utilization of larger size material for armoring. Pebble to boulder sized pieces of brick, paving stone, asphalt and broken concrete amount to 5% to 15% of the total fill. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03118

DEGLACIATION AND PROGLACIAL DRAINAGE: NORTH BAY-MATTAWA REGION, ONTARIO.
Syracuse Univ., N.Y. Dept. of Geology.
J. E. Harrison.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N. Y., Part 2: International Association for Great Lakes Research, p 756-767, 1970. 9 fig, 1 tab, 9 ref.

Descriptors: *Glaciation, *Geomorphology, *Paleohydrology, *Great Lakes, *Pleistocene epoch, Topography, Alluvial channels, Lakes, Glacial drift, Erosion, Scour, Land forming, Valleys, Surveys, Terrain analysis, Beaches, Water levels.
Identifiers: Mattawa (Ontario).

Striae, crag and tail features, drumlins, and discontinuous moraines in the Mattawa Valley, Ontario show the complex lobation of the ice margin during deglaciation. While ice occupied the Lake Nipissing basin, retreat of the Algonquin highland ice allowed proglacial lake water to drain eastward into the upper Petawawa River. The altitude of the highest spillway investigated is 1,175 ft although higher routes are believed to exist. Retreat from the Rutherglen moraine allowed proglacial lake waters to escape over the Mink Lake sill at 1,075 ft while to the west, the uplands north of North Bay became ice free. Shrinking of the lobe occupying the Mattawa-Ottawa River drainage route south of Mattawa allowed water to escape into a lower lake. This lake was held by an ice dam across the valley between Deux Rivières and Bissett Creek. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03119

MIXED-POPULATION SEDIMENT IN NEARSHORE ENVIRONMENTS.
United States Lake Survey, Detroit, Mich.
S. B. Upchurch.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N. Y., Part 2: International Association for Great Lakes Research, p 768-778, 1970. 6 fig, 16 ref.

Descriptors: *Sediment transport, *Sedimentation, *Lake Superior, *Lake Michigan, Bed load, Suspended load, Provenance, Sedimentology, Sampling, Data collections, Analytical techniques, Statistical methods, Littoral drift, Erosion, Deposition (Sediments), Particle size, Distribution patterns, Great Lakes.

Mixed-population analysis of sediment can be used to determine littoral drift directions, provenance, erosion and deposition sites, and beach stability. The method requires that sediment be composed of lognormal components representing different sources or depositional processes. Observations need be made only once for provenance and depositional environment studies, and twice, separated by a short interval, for drift and erosion-deposition studies. At Little Lake Harbor, Lake Superior, littoral sediment is derived from glacio-lacustrine strata and consists of pebble-cobble and fine to medium sand populations. Shifts of these populations indicate littoral drift directions and erosion-deposition sites. At Little Sable Point, Lake Michigan, sediment is fine to medium sand, differentiated during transportation and deposition into beach and eolian sediments. The traction, saltation, and suspension loads can be recognized and attributed to the depositional environments. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03120

ATMOSPHERIC CONSTITUENTS NEAR LAKE ERIE.

Atmospheric Physics and Chemistry Lab., Boulder, Colo.
P. A. Allee, T. B. Harris, Jr., and R. Proulx.

Field 02—WATER CYCLE

Group 2H—Lakes

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 779-789, 1970. 15 fig, 23 ref.

Descriptors: *Meteorological data, *Data collections, *Air pollution, *Meteorology, *Snowfall, Lake Erie, Great Lakes, Nucleation, Aerosols, Air environment, Pollutant identification, Air pollution effects, Atmospheric physics.

During the fall seasons of 1968 and 1969 an aircraft probed the atmosphere above and in the vicinity of Lake Erie to study various meteorological conditions with special emphasis upon those days when the lake-effect snowstorms were present. Among the parameters measured during these flights were the concentration of Aitken nuclei, cloud droplet condensation nuclei, and ice nuclei. On fair weather flights in the vicinity of Buffalo, New York, additional measurements were made of the concentration of carbon dioxide, oxidant, reductant, and ozone. Local human contributions to these atmospheric constituents can be detected and measured, and some observations suggest possible effects upon the weather. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03121

ICE DATA COLLECTION AND USAGE: EMPHASIS ON PREDICTION TECHNIQUES. Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div. F. E. Chase, J. L. Baker, and E. W. Lewis. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 790-797, 1970. 3 tab, 9 ref.

Descriptors: *Ice, *Iced lakes, *Great Lakes, Freezing, Ice breakup, Navigation, Melting, Lake ice, Forecasting, Data collections, Data processing, Meteorology.

Ice data collected for the Great Lakes are used for: (1) ice forecasts; (2) reports on actual conditions; (3) special prediction such as estimates of port access; (4) forecast input data such as wind, air and water temperature, ice conditions, lake state, local factors, and historical data; and (5) ice research data such as ice physics, local time histories and variables in ice formation and break-up, water-air circulation and energy balance radiation, and regional economic data. The users and collectors of ice data, and organizations involved in research on ice problems are listed. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03122

SPECTRA OF MONTHLY MEAN WATER LEVEL IN THE GREAT LAKES. Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch. L. F. Ku. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 844-861, 1970. 19 fig, 6 tab, 12 ref.

Descriptors: *Water level fluctuations, *Great Lakes, *Variability, *Frequency analysis, *Fourier analysis, Annual, Time series analysis, Statistics, Statistical methods.

The annual variation and its harmonics are significantly parts of the spectra of monthly mean water level in the Great Lakes. The energy of the spectra is concentrated in low frequencies and the plots of background in the spectra at all stations are similar. The coherent energy between Lake Superior and each of the other Lakes is relatively lower than that of other pairs. The phase of annual variation increases from east to west. In Lake Su-

perior it lags about 2 months behind that of Lake Ontario. The amplitude decreases as the number of points increases. For Lakes Superior, Huron, and Erie the amplitudes approach 6 cm when 48 years of data are used. The amplitude in Lake Superior is the same as that in Lake Erie, and its value in Lake Ontario is 12 cm larger than that in Lake Huron. Owing to the relatively small contribution towards the variance by the annual term and its harmonics, it is not practical to predict the monthly mean water level using only the periodic components. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03123

WIND-GENERATED CIRCULATIONS IN LAKES 'ERIE, HURON, MICHIGAN AND SUPERIOR. Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch. T. S. Murty, and D. B. Rao. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 927-941, 1970. 8 fig, 11 ref.

Descriptors: *Great Lakes, *Water circulation, Winds, Currents (Water), Lake Erie, Lake Huron, Lake Michigan, Lake Superior, Climatology. Identifiers: *Lake circulation.

The wind-generated circulations in Lakes Erie, Huron, Michigan, and Superior were computed using a steady state linear model with topography and rotation taken into account. This homogenous model applicable to late fall and early spring situations only. The Lake Erie circulation pattern has three cells. An elongated clockwise cell near the southern shore terminates at its western basin. This cell becomes strong to the east of Erie and persists to midway between Silver Creek and Buffalo. The second cell is clockwise and is in the northern part of the lake. The third cell is clockwise and is in the northeastern part of the lake. The circulation pattern in Lake Huron has four cells. In the eastern part there is a strong counterclockwise cell. In the western part there is a clockwise cell. Most of the Georgian Bay is occupied by an intense counterclockwise cell. There is a weak clockwise cell in the western part of the Georgian Bay. In Lake Michigan there are two cells: a clockwise cell in the western part and a counterclockwise cell in the eastern part. The circulation in Lake Superior is by far the most unorganized with generally counterclockwise motion in the southern portions and weak clockwise motions in the northern portions. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03124

FACTORS AFFECTING THE PROGRESS OF THE THERMAL BAR OF SPRING IN LAKE ONTARIO. Toronto Univ. (Ontario). Great Lakes Inst. G. K. Rodgers, and G. K. Sato. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 942-950, 1970. 3 fig, 3 tab, 15 ref.

Descriptors: *Thermal stratification, *Thermocline, *Lake Ontario, Water temperature, Great Lakes, Limnology, Stratification, Solar radiation. Identifiers: *Thermal bar.

The primary control of the spring thermal bar movement in Lake Ontario is surface heating and the initial heat content of the 'cold' section of the Lake into which the thermal bar moves. Heat content in the deep section on 1 April is related to the date of disappearance of the thermal bar. The date can be predicted to within 4 days. The heat content of the deep part of the Lake on 1 April (relative to

heat content of the Lake when stratification just starts) varied by a factor of 2. The average heat flux through the lake surface during the months of April and May in these years varied by only 15% from the mean. Progress of stratification is controlled primarily by surface heating and initial lake temperatures in the deep part of the Lake and by flow of waters greater than 4 deg C into a lake at temperatures less than 4 deg C. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03125

A COMPARISON OF COMPUTED AND MEASURED CURRENTS IN LAKE SUPERIOR. Wisconsin Univ., Madison. Marine Studies Center. N. P. Smith, and R. A. Ragotzkie. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 969-977, 1970. 21 fig, 9 ref.

Descriptors: *Currents (Water), *Water circulation, *Lake Superior, Great Lakes, Climates, Meteorology, Data collections, Hydrography, Current meters, Water temperature, Mathematical models.

Currents and water temperatures were measured from anchor stations along three tracks extending from the north shore of the Keweenaw Peninsula in Lake Superior on July 6, 1969. Cross-sections of the geostrophic current components normal to the track were compared with cross sections of the corresponding components of the measured currents. Measured current patterns were spatially much more variable both horizontally and vertically, and measured currents were generally stronger than the computed current. Computed current velocities reached 15 cm/sec on two occasions, but were generally less than 10 cm/sec. Computed currents were restricted to the upper 30 meters. The normal component of the measured currents was often over 30 cm/sec in some part of the cross-section, and significant speeds extended down to 60 m, the assumed level of no motion chosen for the dynamic height computations. This indicated that the baroclinic component is sometimes only a small part of the total current. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03126

WATER SURFACE TEMPERATURE MEASUREMENT USING AIRBORNE INFRARED TECHNIQUES. Barnes Engineering Co., Stamford, Conn. Remote Sensing Dept. M. Weiss. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 2: International Association for Great Lakes Research, p 978-989, 1970. 9 fig, 1 tab, 11 ref.

Descriptors: *Remote sensing, *Water temperature, *Infrared radiation, Aerial photography, Great Lakes, Path of pollutants. Identifiers: Infrared radiometers.

Techniques for rapidly measuring water surface temperature over large areas to an absolute accuracy of better than 0.5-1.0 deg C are now accomplished with the aid of highly sensitive, rugged infrared radiometers used on airborne platforms. Examples are given of a variety of surface temperature patterns measured in aerial surveys of the Great Lakes, thermal pollution of bodies of water from power plant water usage, and temperature patterns obtained from a satellite. Limitations of measurement accuracy and some methods for correcting the data are discussed. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-03127

A STUDY OF THE HEAT LOSS OF THE ST. LAWRENCE RIVER BETWEEN KINGSTON AND CORNWALL,
Department of Energy, Mines and Resources, Ottawa (Ontario), Inland Waters Branch.
D. F. Witherspoon, and R. Y. Poulin.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N Y, Part 2: International Association for Great Lakes Research, p 990-996, 1970. 4 fig, 1 tab, 5 ref.

Descriptors: *Ice, *St. Lawrence River, *Water temperature, *Model studies, Mathematical models, Ice jams, Navigation, Cooling, Freezing, Heat balance, Heat transfer.

A model of the water temperature of the St. Lawrence River uses an empirical relationship of the air and water temperature difference and the heat loss from the water surface. Airborne radiation thermometer data determine the initial state condition of the river. Observed air temperature data are used to estimate the cooling of the river. The calculated temperatures check with ground measurements within 1 deg F, 9 days after the initial state measurement, a relationship of the heat loss to the velocity is given for the five reaches which have similar hydraulic characteristics between Kingston and Cornwall. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03128

DATA PREPARATION FOR WATER RESOURCE STUDIES,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.

G. A. Fuller, and H. M. Hill.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N Y, Part 2: International Association for Great Lakes Research, p 997-1003, 1970. 3 tab, 12 ref.

Descriptors: *Hydrologic data, *Data processing, *Statistics, *Regression analysis, Data collections, Streamflow forecasting, Great Lakes, Variability, Runoff forecasting, Water levels, Water level fluctuations.

The planning and management of a large water resources system, such as the Great Lakes, usually requires large amounts of hydrologic data. Often values are missing from these records. These missing values are generally estimated by regression on streamflow data from nearby streams. However, it has been found that regression analysis does not always give satisfactory predictions from hydrologic data. This paper presents an alternative method for estimating missing data, using regression analysis on the principal components of the data. The principal component regression and conventional regression models for estimating missing data are compared using monthly and daily streamflow data. The proposed method gives better predictions when streamflow records are short; however, when long records are available predictions by the two methods are approximately the same. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03129

A SUBMERSIBLE SELF-CONTAINED WATER QUALITY METER,
Plessey Co., Ltd., Ilford (England). Environmental Sensor Div.
G. F. Hodges.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, N Y, Part 2: International Association for Great Lakes Research, p 1004-10014, 1970. 9 fig, 1 tab, 5 ref.

Descriptors: *Monitoring, *Instrumentation, *Water quality, *Data collections, Current meters, Dissolved oxygen, Hydrogen ion concentration,

Suspended load, Water temperature, Telemetry, Conductivity.
Identifiers: *Water quality monitoring.

A submersible water quality monitoring instrument is powered by rechargeable batteries and automatically scans and digitally records on magnetic tape eight water quality parameters. The type of sensors used, the recording system and method of operation are discussed. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS)
W72-03130

THE 1967 ALTUS RESERVOIR SEDIMENT SURVEY,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 02J.
W72-03158

THE LAKE TAP AT THE ASKARA HYDROELECTRIC PROJECT,
Grøner (Chr. F.) A/S, Oslo (Norway).
For primary bibliographic entry see Field 08A.
W72-03213

SPRING AND SUMMER CHIRONOMIDAE OF UNIVERSITY LAKE, CHAPEL HILL, NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 05C.
W72-03231

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05G.
W72-03234

CHANGES IN THE ABUNDANCE OF GOLDEYE, HIODON ALOSOIDES (RAFINESQUE) IN LAKE TEXOMA, OKLAHOMA,
Oklahoma Univ., Norman.
William L. Shelton.
Proc Okla Acad Sci. 49: 184-187. 1970.
Identifiers: Abundance, Goldeye Hiodon Alosoides, Lake, Oklahoma, Texoma, USA.

Initially abundant (1948-1949), the population declined, reached a low in 1957, and by 1968 had recovered its original density. A period of low lake level, 1952-1957, during the probable spawning months, may have reduced spawning success sufficiently to affect the subsequent population.—Copyright 1971, Biological Abstracts, Inc.
W72-03285

DISTRIBUTION AND ABUNDANCE OF THE ZOOPLANKTON OF CANTON RESERVOIR, OKLAHOMA,
Oklahoma Fishery Research Lab., Norman.
Joseph T. Yacovino.
Proc Okla Acad Sci. 50: 87-90. Illus. 1970.
Identifiers: Abundance, Bosmina, Canton, Ceriodaphnia, Daphnia, Diaphanosoma, Diaptomus, Distribution, Oklahoma, Plankton, Reservoir, Zoo.

The plankton of Canton Reservoir was sampled during 1967 and 1968. Spring pulses were noted both years. Plankton volumes also varied with horizontal location and depth. Entomostracans represented in the samples were cyclopoid copepoda, Diaptomus, Daphnia, Bosmina, Diaphanosoma, and Ceriodaphnia. Of these, only Daphnia and Diaptomus showed any vertical layering; the others occurred in about the same abundance at all depths. Daphnia and Diaptomus were the dominant springtime zooplankters, while Bosmina was dominant in summer and fall.—Copyright 1971, Biological Abstracts, Inc.

W72-03374

PHYSICOCHEMICAL CONDITIONS OF BOOMER LAKE, PAYNE COUNTY, OKLAHOMA,
Oregon State Univ., Corvallis.
Richard E. Craven, and Bradford E. Brown.
Proc Okla Acad Sci. 49: 23-29. Illus. 1970.
Identifiers: Boomer, County, Dissolved, Lake, Oklahoma, Oxygen, Payne, pH, Physicochemical, Temperature, Transparency, Vegetation.

Dissolved O₂, pH, temperature, and Secchi disc transparency were determined from March 1966 through Feb. 1967. pH near the bottom ranged from 7.2 to 9.0. Transparency of the water varied seasonally and was affected by wind and amount of rainfall. Only during June and July did dissolved O₂ concentrations fall below 2 mg/l. Anoxic conditions were recorded several times. Temperature profiles indicated that the lake water was constantly undergoing circulation. Rainfall during July partially was responsible for elimination of littoral vegetation in some areas.—Copyright 1971, Biological Abstracts, Inc.
W72-03375

CONDITION FACTORS AND GROWTH IN LENGTH OF A STUNTED WHITE CRAPPIE POPULATION IN BOOMER LAKE, PAYNE COUNTY, OKLAHOMA,
Bureau of Commercial Fisheries, Woods Hole, Mass. Biological Lab.
Bradford E. Brown, and Jesse J. Jossel, Jr.
Proc Okla Acad Sci. 49: 156-162. 1970.
Identifiers: Benthic, Boomer, Condition, County, Crappie, Fauna, Growth, Lake, Length, Low, Management, Oklahoma, Payne, Pomoxis-Annularis, Population, Stunted, Turbidity, White.

Average growth rate and condition factor for crappie Pomoxis annularis from this 102-ha lake in 1966 were quite low when compared with results reported from other Oklahoma reservoirs. Growth of Boomer Lake white crappie was essentially the same as reported for white crappie from the lake in 1950 and 1953. High turbidity and relatively low standing crops of benthic fauna are possible causes of this phenomenon. The failure of any management benefits reflected in 1966 from a 1953 rotenone demonstration the need for continuous management.—Copyright 1971, Biological Abstracts, Inc.
W72-03376

USE OF SHANNON'S FORMULA IN DESCRIBING SPATIAL AND TEMPORAL VARIATION IN A ZOOPLANKTON COMMUNITY IN KEYSTONE RESERVOIR, OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of zoology.
Kenneth A. Kochsieck, and Jerry L. Wilhm.
Proc Okla Acad Sci. 49: 35-42. Illus. 1970.
Identifiers: Community, Describing, Formula, Keystone, Oklahoma, Plankton, Reservoir, Shannons, Spatial, Temporal, Zoo.

Shannon's formula was used to analyze diurnal variation of zooplankton community structure. Twenty spp. were collected during the study and temporal variation in numbers of species and individuals was observed. Spatial variation in species diversity, d, was related to physicochemical conditions. Despite vertical migration of certain species, variations in numbers of individuals between day and night samples, and the patchiness of species, temporal variation in d, at a particular depth was less variable than spatial variation at a particular time.—Copyright 1971, Biological Abstracts, Inc.
W72-03377

CONTRIBUTIONS TO THE STUDY OF THE BIOLOGY OF LAKE SARAT OF BRAILA,
Elena Onea, Florica Carausu, Violeta Caruntu, Veronica Cristea, and Vladimir Olaru.

Field 02—WATER CYCLE

Group 2H—Lakes

Comun Zool. 4: 47-60. Illus. 1966. (Russian and English summary).
Identifiers: Artemia-Salina, Biology, Braila, Fauna, Flora, Lake, Romania, Sarat.

The average conditions in 2 locations are different, even though the lake's area is small. This is reflected in the values concerning transparency, temperature and salt concentration, which vary for the 2 stations. New forms of fauna and flora are recorded in the area. *Artemia salina* was found tolerant to great salinity and temperature variations.—Copyright 1971, Biological Abstracts, Inc. W72-03381

AQUATIC PLANTS AND AQUATIC PLANT VEGETATION IN THE PONDS OF DE HAAK NEAR SLIKKENDAM (PROVINCE OF ZUID-HOLLAND, NETHERLANDS), (IN DUTCH), Rijkswaard Natuur., Amsterdam (Netherlands). A. J. Den Held, J. J. Den Held, and E. X. Maier. *Gorteria*. 5 (2): 21-35. Illus. 1970. English summary.
Identifiers: Aquatic, Ceratophyllum-Demersum-D., Chara-Aspera, Chara-Globularis, Chara-Hispida, De, Elodea-Nuttallii-M., Haak, Holes, Lemna-Gibba-M., Najas-Marina-M., Netherlands, Nitella-Flexilis, Nitellopsis-Obtusa, Peat, Plant, Plants, Ponds, Province, Slikkendam, Vaucheria, Vegetation, Zuid-Holland.

The pools are situated in marshwood peat. The water is about 1 m deep, is slightly oligohaline, has a medium calcium content, and is hardly polluted. In the south the peat holes communicate with a ditch containing water which is comparatively rich in phosphate and nitrite. The increase in pollution and in the phosphate content to the south is demonstrated by the growing abundance of *Ceratophyllum demersum* and/or *Vaucheria* cf. *dichotoma* Ag., accompanied by species such as *Elodea nuttallii* and *Lemna gibba*. In the undisturbed parts of most peat holes there is luxuriant vegetation of *Najas marina* and several Characeae: *Nitellopsis obtusa* (Desv.) J. Groves, *Nitella flexilis* Ag., *Chara hispida* L., *C. globularis* Thuill. and *C. aspera* Willd. *Nitellopsis obtusa* formed abundant antheridia and oogonia, and in one place plants bearing ripe oospores were found. Some ecological remarks are made, both on the species already mentioned and on other water plants occurring there. The syntaxonomical position of the *Najas marina* and Characeae is discussed. De Haak represents the last remainder of the undisturbed exosystem of partly dug out peat layers in the surroundings of Nieuwkoop. It forms an unique link in the series of peat holes areas (from mesohaline to fresh; from only peaty to peat lying on clay or sand) in the western part of the Netherlands.—Copyright 1971, Biological Abstracts, Inc. W72-03468

RATIONALE, BACKGROUND, AND DEVELOPMENT OF EXPERIMENTAL LAKE STUDIES IN NORTHWESTERN ONTARIO
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
W. E. Johnson, and J. R. Vallentyne.
J Fish Res Bd Can. 28 (2): 123-128. Map. 1971.
Identifiers: Background, Canada, Development, Eutrophication, Lake, Northwestern, Ontario, Rationale.

Reasons why experimental lake studies form a useful addition to more conventional laboratory experiments and observational field studies of eutrophication are discussed. The developmental history of the Experimental Lakes Area is given, including reasons for the location and a general description of the area set aside for experimental manipulation.—Copyright 1971, Biological Abstracts, Inc. W72-03471

PERIPHYTON OF THE EXPERIMENTAL LAKES AREA, NORTHWESTERN ONTARIO
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
John G. Stockner, and F. A. J. Armstrong.
J Fish Res Bd Can. 28 (2): 215-229. 1971.
Identifiers: Achnanthes-Flexella, Achnanthes-Minutissima, Algae, Biomass, Blue-Green, Canada, Eunotia-Pectinalis, Green, Lakes, Northwestern, Ontario, Periphyton, Succession.

The periphyton of 4 Experimental Lakes Area (ELA) lakes were examined in 1969. The littoral zone of all lakes was composed chiefly of large boulders and rock shelves and the epilithic algal assemblage was accordingly dominant. Depending directly on light penetration and substrate availability benthic algal growth in most lakes was negligible at depths greater than 10 m. Throughout the growing season diatoms were the dominant algal group within the epilithic assemblage, comprising more than 60-70% of the total volume. Filamentous green and blue-green algae increased in importance in July and August but never constituted more than 40% of the volume of the total algal biomass. A well-defined diatom succession was observed both on the natural lithic substrate and on glass slides. *Achnanthes minutissima* was the most abundant diatom encountered in the littoral zone of all lakes. Periphyton growth on glass slides in lake 240 was 27 mg organic matter/m² day during initial colonization and 250 mg organic matter/m² day during the period of maximum growth. The vertical distribution of littoral diatoms in the lake 240 was examined and differences among species are discussed in light of possible regulating mechanisms. *A. flexella* and *Eunotia pectinalis* were found only in the psammal habitat of lake 240. Statistical treatment of chemical analyses of N, P, and chlorophyll a content of periphyton showed no significant differences in amounts of total N among periphyton from lakes, but the distribution of both total P and chlorophyll a was significantly different among lakes examined. Highest concentrations of both P and chlorophyll a were found in lakes 239 and 227. In lake 227, a lake receiving weekly additions of N and P, concentrations of P were significantly greater than in the other lakes. Concentrations of N and P/unit organic weight of periphyton taken at a depth of 1 m in each of the study lakes were greatest in lake 227. Comparisons among lakes are made and, based on the results of these comparisons, the role of N and P as regulators of periphyton growth in the ELA lakes is discussed.—Copyright 1971, Biological Abstracts, Inc. W72-03476

VERTICAL DISTRIBUTION AND SEASONAL ABUNDANCE OF ZOOPLANKTON IN TWO SHALLOW LAKES OF THE EXPERIMENTAL LAKES AREA, N. WEST. ONTARIO
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, and Bengt Noven.
J Fish Res Bd Can. 28 (2): 245-256. Illus. 1971.
Identifiers: Abundance, Bosmina-Longirostris, Canada, Cyclops-Bicuspidatus-Thomasi, Diaptomus-Minutus, Distribution, Holopedium-Gibberum, Lakes, Leptodora-Kindtii, Northwestern, Ontario, Plankton, Rotifers, Seasonal, Shallow, Vertical, Zoo.

Seasonal variations in the abundance of zooplankton were studied in lakes 122 and 132 for a period of 10 mo. beginning in mid-May 1968. Seasonal dynamics of various species are discussed in relation to their patterns in the Canadian Shield and in other localities. Day and night vertical distributions for each lake were sampled on 2 dates in summer. Three spp. of rotifers migrated diurnally in lake 122, but no evidence of diurnal movement was found in lake 132. All crustaceans studied in both lakes migrated vertically to some degree, except for nauplius larvae and *Leptodora kindtii*. There was little difference in vertical distribution patterns on the 2 dates studied. Average zooplankton biomass in the 2 lakes was calculated and com-

pared with that found in other studies. Average zooplankton biomass during the ice-free season was 72 and 156 mg/m³ dry weight for lakes 122 and 132, respectively. Dominant species in both lakes were *Diaptomus minutus*, *Cyclops bicuspidatus thomasi*, *Holopedium gibberum*, and *Bosmina longirostris*. Ecological tolerances for rotifer species agreed well with those found for Swedish waters.—Copyright 1971, Biological Abstracts, Inc. W72-03478

ZOOBENTHOS OF FIFTEEN LAKES IN THE EXPERIMENTAL LAKES AREAS, NORTHWESTERN ONTARIO
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
Andrew L. Hamilton.
J Fish Res Bd Can. 28 (2): 257-263. Illus. 1971.
Identifiers: Benthos, Canada, Chaoborinae, Chironomidae, Lakes, Northwestern, Ontario, Pisidium-Conventus, Pontoporeia-Affinis.

The composition of the profundal and sublittoral zoobenthos of 15 lakes in northwestern Ontario was closely related to morphometric features of the individual lakes. The amphipod *Pontoporeia affinis* Lind., and the sphaeriid *Pisidium conventus* Clessin, were the dominant species in the larger deeper lakes whereas species of Chironomidae and Chaoborinae were the dominant forms in all lakes with mean depths of less than 10 m. Dissolved O₂ concentration and temperature of the bottom water, 2 characteristics that are largely a function of lake morphology, are probably the primary factors limiting the distribution of individual species.—Copyright 1971, Biological Abstracts, Inc. W72-03479

PRELIMINARY CHARACTERIZATION OF LAKES IN THE EXPERIMENTAL LAKES AREA, N. WEST. ONTARIO, USING DIATOM OCCURRENCES IN SEDIMENTS
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
John G. Stockner.
J Fish Res Bd Can. 28 (2): 265-275. 1971.
Identifiers: Canada, Cyclotella, Diatom, Lakes, Melosira, Northwestern, Ontario, Sediments.

Diatoms in deepwater surface sediment from 16 Experimental Lakes Area (ELA) lakes of varying size and morphology were separated for analysis on the basis of their generally understood habitat preference into littoral and planktonic groups. The lakes were ranked in order of increasing relative abundance of littoral diatoms recovered from deepwater surface sediment. A significant correlation was found between the abundance of littoral diatoms in deepwater sediments and the morphometric variables: lake surface area (A₀), and shoreline length to lake volume (L/V), and percent littoral development in each lake. The Centrales were the dominant planktonic group in most of the ELA lakes examined. Species of *Cyclotella* and *Melosira* were the dominant diatoms in most ELA lakes. The ratio of the 2 planktonic groups-Araphidineae and Centrales (A/C)—calculated from sediment counts, agreed closely with the A/C ratio enumerated from 1969 phytoplankton counts in 2 lakes compared. Based on a lake classification scheme using values of the A/C ratio from sediment diatom counts, the majority of ELA lakes were classed as oligotrophic. Analysis of a 155-cm core from lake 240 showed little change in diatom species composition over the past 3000-4000 yr. Centrales was the dominant diatom assemblage at all sediment depths. The dominant diatoms in the sediment of lake 240 and the majority of ELA lakes examined were similar to those dominant in the deepwater sediments of well-studied oligotrophic lakes in other lake districts. On the basis of calculated A/C ratios in surface sediment in several lakes at temperate latitudes, a lake trophic classification is proposed.—Copyright 1971, Biological Abstracts, Inc. W72-03480

ICHTHYOFAUNA OF THE DOLGAN LAKE AND ITS SIGNIFICANCE IN TRADE, Y. P. Larionov.

Tr Yakutsk Otd Sib Nauchno-Issled Inst Rybn Khoz. 3, 205-216. 1969. Translated from Ref Zh Biol, 1970, No. 41257.

Identifiers: Coregonus-Peled, Dolgan, Esox-Lucius, Fauna, Growth, Ichthyology, Lake, Midge, Mollusks, Nutrition, Perca-Fluviatilis, Rutilus-Rutilus, Trade, USSR.

Ichthyofauna of the Dolgan Lake (Yakutsk Autonomous SSR) is presented by peled (*Coregonus peled*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*) and pike (*Esox lucius*). Study of their growth, nutrition and biology of reproduction was conducted. By food resources, the lake is referred to as the central feeder. Fish catch on the lake is done sporadically. The catches of spring and fall of 1965 left over 200 centners of which 80% were peleds. Perch takes the 2nd place. In peleds, perches and roaches feeding on benthos (mollusks, larva, midges and others), competition is noted. Trap net catch in March and Aug.-Sept. is recommended. Productivity of the lake is 10-15 kg/ha.—Copyright 1971, Biological Abstracts, Inc. W72-03490

PHYSICAL LIMNOLOGY OF LAKE GENEVA (SWITZERLAND): STUDY OF THE SEDIMENTS IN THE NERNIER PIT, Geneva Univ. (Switzerland). Inst. of Geology and Paleontology.

J. P. Vernet, and C. Parent.
C R Seances Soc Phys Hist Natur Geneve. 5 (2/3): 205-215. Illus. Map. 1970 English summary.

Identifiers: Geneva, Lake, Limnology, Nernier, Physical, Pit, Pollution, Sediments, Switzerland.

The study of the sedimentology of 3 cores from the occidental part of the lake of Geneva (Switzerland) shows the physical constitution of the sediments and their stratigraphy. The general clay composition is: illite 50%, chlorite 30%, kaolinite 10% and montmorillonite and/or mixed layer 10%. The presence of well crystallized montmorillonite in the Tardiglacial formations was noted. The superficial sediments show pollution by Cu, Zn and Ba.—Copyright 1971, Biological Abstracts, Inc. W72-03492

OBSERVATIONS ON SEDIMENTATION IN THE ARTIFICIAL MONTSALVAN LAKE, IN FRIBOURG CANTON (SWITZERLAND), Petroconsultants S. A., Geneva (Switzerland).

Michel Godel, Daniel Kissling, and Gilles Carboneel.

C R Seances Soc Phys Hist Natur Geneve. 5 (2/3): 190-202. Illus. Map. 1970. English summary.

Identifiers: Artificial, Canton, Fribourg, Lake, Montsalvan, Ostracod, Pisidium, Sedimentation, Switzerland.

Sedimentation in the artificial Lake of Montsalvan was observed during the autumn 1968 when the lake was empty. A total of 2.3 million m cu. of sediments were deposited during a period of 48 yr. This corresponds to an average of 280 cm cu per year and per square kilometer of the basin. Detailed observation of the stratigraphy of the sediments shows no annual cycles but shorter cycles related to rainfall. Type of sediments and depositional conditions are constant during the whole lake history. A rather complete ostracod population develops after about 10 yr and 1 lacustrine *Pisidium* species appears about 3 yr after the creation of the lake.—Copyright 1971, Biological Abstracts, Inc. W72-03493

FIRST CONTRIBUTION TO THE LIMNOLOGICAL KNOWLEDGE OF THE LAGOONS AND ARTIFICIAL PONDS OF CUBA, Ceskoslovenska Akademie Ved, Prague.

Hydrobiologicka Lab.
M. Straskraba, M. Legner, J. Fott, J. Holcik, and Legnerova.

Acad Cienc Cuba Ser Biol. 4. 3-44. Illus. Map. 1969. English summary.

Identifiers: Artificial, Cuba, Lagoons, Limnological, Phyto, Plankton, Ponds, St, Zoo.

Studies are presented of physico-chemical, phytoplankton, zooplankton and productivity of 17 ponds and lagoon areas in Cuba. Data obtained are compared with similar studies in Czechoslovakia.—Copyright 1971, Biological Abstracts, Inc. W72-03501

21. Water in Plants

DISTANCE BETWEEN FOOD AND WATER SUPPLY AND ITS EFFECT ON DRINKING FREQUENCY, AND FOOD AND WATER INTAKE OF MERINO AND BORDER LEICESTER SHEEP.

Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Div. of Plant Industry.

V. R. Squires, and A. D. Wilson.
Aust J Agr Res. 22 (2): 283-290. Illus. 1971.

Identifiers: Border, Bush-D, Distance, Drinking, Food, Frequency, Intake, Leicester, Merino, Pastoral, Salt, Sheep.

The walking and drinking behavior of Merino and Border Leicester wethers was compared in summer 1968 when a diet containing 15% sodium chloride was fed at points that were separated from the water supply by distance of up to 5.6 km. All sheep maintained 2 journeys daily to water until the distance between food and water reached 4.0 km. At this point Merino sheep drank 3 times every 2 days and at 4.8 km once a day. Border Leicesters drank twice daily until the distance reached 5.6 km, when they drank once daily. Food intake declined in both breeds as distance from water increased, but water intake was reduced only at the longer distances. When drinking once daily, water intakes were as much as 7 and 10 liters respectively for Merino and Border Leicester sheep. Walking distances reached a maximum of 13.6 and 17.6 km/day respectively for the Merinos and Border Leicesters. The average walking speed of the Merinos (2.51 km/hr) was greater than that of the Border Leicesters (2.06 km/hr). The implications for management of saltbush pastoral areas are discussed.—Copyright 1971, Biological Abstracts, Inc. W72-02993

NEW PLANT ASSOCIATIONS IN THE SUB-CARPATHIAN WATERSHED OF THE SLANICUL DE BUZAU, Institutul Agronomic, Bucharest (Romania).

V. Ciocarlan.
Lucrari Stiint Inst Agron 'N Balcescu' Ser A. 12: 367-374. Map. 1969. English, French and Russian summaries.

Identifiers: Associations, Festuca-M, New, Onobrychis-D, Phytosociology, Plant, Romania, *Slanicul-De-Buzau, *Subcarpathian, Watershed.

The paper presents 2 new associations: *Festuco rupicola*-*Onobrychietum* and *Festucetum valesiacae* pontico-romanicum. Three new subassociations are also described. The new associations have been created on the basis of the regional species and ecological criteria. The description of the associations is accompanied by phytocenological tables.—Copyright 1971, Biological Abstracts, Inc. W72-02996

ORIGIN OF THE PLANT FORMATIONS OF OUR LLANOS, Instituto Botanico, Caracas (Venezuela).

Tobias Lasser.
Acta Bot Venez. 4 (1-4): 23-52. 1969.

Identifiers: Depression, Displacement, Forest, Formations, Grasses-M, *Llanos, Origin, Plant, Table, *Venezuela.

The llanos constitute a gently rolling area of some 280,000 km sq formed by Quaternary deposits occupying the basin of a Tertiary sea. They are largely grass-covered with isolated woods and galleries following the watercourses. Humidity is the limiting factor for forest growth. The author argues that the progressive elevation of the land (which is still occurring in the Orinoco Delta) and consequent depression of the water-table are chiefly responsible for the displacement of forest cover by sward. In support of the view that the llano depression has largely been colonized by a flora native to the adjacent mountains, the author appends 'A sample of the vegetation of the llanos and its presence in the limiting Cordilleras' comprising 706 plant species, of which 527 or 75% are also to be found in one or more of the 3 neighboring areas.—Copyright 1971, Biological Abstracts, Inc. W72-02997

SURVEY OF THE DETERMINING FACTORS OF THE CALCAREOUS MARSH AND ITS MOST IMPORTANT CONTACT ASSOCIATIONS IN THE FOOTHILLS OF THE BAVARIAN ALPS, Bayerische Landesanstalt fuer Bodenkultur, Pflanzenbau und Pflanzenschutz, Munich (West Germany).

W. Braun.
Ber Bayer Bot Ges Erforschung Heim Flora. 42: 109-138. Maps. 1970.

Identifiers: Alps, Associations, Bavarian, Calcareous, Contact, Determining, Foothills, Germany, Indicator, *Marsh, Phytosociology, Species, Survey.

A phytosociological analysis of 28 associations from Bavarian calcareous marsh is presented with information on their relationships and subgroups and on indicator species.—Copyright 1971, Biological Abstracts, Inc. W72-02998

TROLLIUS EUROPAEUS, Polskie Towarzystwo Przyrodników im. Kopernika, Warsaw.

L. Pomarnacki.
Wszechswiat. 9. 246-247. Illus. 1970.

Identifiers: Habitats, Morphology, *Trollius-Europaeus-D.

The plant occurs on wet meadows, in forests and clearings. It is a perennial from the family Ranunculaceae, reaching 60 cm, with bright-yellow flowers. *Trollius europaeus* is under protection in Poland.—Copyright 1971, Biological Abstracts, Inc. W72-02999

NOTES ON THE USE OF DESERT SPRINGS BY BIRDS IN CALIFORNIA, Adelaide Univ. (Australia). Dept. of Zoology.

Michael Smyth, and Harry N. Coulombe.
Condor. 73 (2): 240-243. Illus. 1971.

Identifiers: Air, Birds, California, *Desert, Dove, Springs, Temperature.

Birds were watched at and around 2 desert waterholes in California. Several species of insectivorous, carnivorous and fructivorous birds did not drink at air temperatures up to 40C. All granivorous birds drank regularly. Most birds that drank did so at mid-morning. Doves, which drink by sucking, lower their heads for longer intervals than birds which drink by dipping and tipping. The osmotic concentration of water at several desert springs was in no case so high that birds could not economically use it.—Copyright 1971, Biological Abstracts, Inc. W72-03010

Field 02—WATER CYCLE

Group 21—Water in Plants

THERMODYNAMICS OF ABSORPTION OF WATER VAPOR FROM THE INTERCELLULAR SPACE OF PLANT LEAVES, Moldavskii Nauchno-Issledovatel'skii Institut Oroschaemogo Zemledeliya i Ovoshchevodstva, Kishinev (USSR).

L. N. Babushkin.

Dokl Akad Nauk SSSR Ser Biol. 194 (1): 211-213. Illus. 1970.

Identifiers: Absorption, Intercellular, Leaves, *Plants, Space, Thermodynamics, Vapor.

The process of absorption of water vapor from the intercellular space of plant leaves is endothermal and consequently there is no condensation of the vapor. The constant occurrence of absorption is probably due to the fact that acceptors of water vapor are continuously regenerated, but heat release was not noted in this case. In this instance the heat energy spent on absorption of vapor should be transformed into other forms of motion. It is proposed that during the absorption of water vapor the heat energy is transformed to hydrodynamic energy of active pressure, which performs important physiological functions in plants.--Copyright 1971, Biological Abstracts, Inc. W72-03030

THE EFFECT OF THE CONDITION OF THE WATER IN PLANT CELLS ON THE COURSE OF THE PHYSIOLOGICAL PROCESSES,

A. M. Alekseev, and G. I. Pakhomova.

Fiziol Biokhim Kul't Rast. 1 (1): 16-20. 1969. English summary. Translated from Ref Zh Biol, 1970, No. 3G156.

Identifiers: Cells, Condition, Leaves, Physiological, *Plants, Processes, Respiration, Transpiration.

The changes in the mobility of the cytoplasmic water at the molecular level may have as a consequence a change in the course of the physiological processes. This was shown by the example of the transpiration of water by the leaves and respiration. This is explained by the dependence of these physiological processes of the mobility of the cytoplasmic water.--Copyright 1971, Biological Abstracts, Inc. W72-03031

STUDIES IN DESERT MICROBIOLOGY: II. DEVELOPMENT OF BACTERIA IN THE RHIZOSPHERE AND SOIL OF ARTEMISIA MONOSPERMA, DEL. IN RELATION TO ENVIRONMENT,

Ain Shams Univ., Cairo (Egypt). Faculty of Science.

For primary bibliographic entry see Field 02G. W72-03036

STUDIES IN DESERT MICROBIOLOGY: III. CERTAIN ASPECTS OF THE RHIZOSPHERE EFFECT OF RHAZYA STRICTA DEC. IN RELATION TO ENVIRONMENT,

Ain Shams Univ., Cairo (Egypt). Faculty of Science.

For primary bibliographic entry see Field 02G. W72-03037

PASTURE SPECIES FOR THE TIPPERARY AREA, NORTHERN TERRITORY, Commonwealth Scientific and Industrial Research Organization, Katherine (Australia). Div. of Land Research.

M. J. Fisher.

Aust Commonw Sci Ind Res Organ Div Land Res Tech Pap. 31: 3-48. Illus. 1971.

Identifiers: Australia, Birdwood, Cenchrus-Setigerus-M, Grass-M, Northern, *Pasture, Savi, Species, Stylo-D, Stylosanthes-Humilis-D, Territory, Tipperary, Townsville, Urochloa-Mozambicensis-M.

A series of pasture-introduction and performance-assessment experiments was conducted between

1962 and 1967 at Katherine, N. T. (rainfall 35 in.) and Tipperary Station (rainfall 45 in.), 100 miles northwest of Katherine. The object of these experiments was to determine the suitability of a range of grasses and legumes for both the higher and lower rainfall parts of the area, using the standard pasture species for Katherine, Townsville stylo (*Stylosanthes humilis*) and birdwood grass (*Cenchrus setigerus*) as reference species. Townsville stylo performed better than all other legumes in most situations, and savi grass (*Urochloa mozambicensis*) was generally superior to birdwood grass as a companion species for Townsville stylo. The management of Townsville stylo and Townsville stylo-based pastures for maximum stable productivity has not been defined but the results suggest that Townsville stylo-savi grass pasture may be easier to manage than either pure Townsville stylo pasture or Townsville stylo-birdwood grass pasture.--Copyright 1971, Biological Abstracts, Inc. W72-03042

MESQUITE AND HUISACHE. SOME ASPECTS OF THE ECONOMY, ECOLOGY AND TAXONOMY OF THE GENERA PROSOPIS AND ACACIA IN MEXICO,

For primary bibliographic entry see Field 03F.

W72-03046

RESULTS OF APPLICATION OF HEAVY WATER (D2O) BY SOVIET AND FOREIGN RESEARCHERS IN THEIR STUDY OF WATER IN PLANTS, CLAY MINERALS AND SOIL (OB OPYTE PRIMENENIYA TYAZHELOY VODY (D2O) SOVETSKIMI I ZARUBEZHNYMI ISSLEDOVATELYAMI PRI IZUCHENII VLAGI V RASTENIYAKH, GLINISTYKH MINERALAKH I POCHVE),

Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.

For primary bibliographic entry see Field 07B.

W72-03070

DEVELOPMENT OF HIGHER AQUATIC VEGETATION IN THE KAMA RESERVOIR (FORMIROVANIYE VYSSHEY VODNOY RASTITEL'NOSTI V KAMSKOM VODOKHRANILISHCHE),

Perm State Univ. (USSR). Lab. of Water Management Research.

For primary bibliographic entry see Field 02H.

W72-03075

TRANSPORT IN THE SOIL-PLANT-ATMOSPHERE CONTINUUM WITH PARTICULAR REFERENCE TO WATER,

Illinois Univ., Urbana.

R. J. Millington, and D. B. Peters.

Scientia, p 1-27, January-February, 1970. 2 fig, 29 ref. OWRR A-031-ILL (1).

Descriptors: *Soil-water-plant relationships, *Hydrologic cycle, *Crop production, *Atmosphere, Circulation (Plants), Soil moisture, Soil water movement, Plant growth, Root systems, Water balance, Transpiration, Leaves, Photosynthesis, Mathematical studies, Water loss, Evapotranspiration.

Plants occupy the central position in the system (soil-plant-atmosphere continuum) deriving from the soil the essential nutrients and water necessary for growth and development and from the atmosphere the carbon dioxide and light energy necessary for the photosynthesis process. Characterization of transport processes in the continuum is essential to the understanding of the relationship of plant performance to the environment. In the soil the mass flow processes are of two kinds, the movement of water along hydraulic gradients and the movement of ions and gases by diffusion. The physical laws and mathematical solutions are summarized. The flow of water in the plant system is shown to obey the same laws governing flow in

soils. Plant water potentials are thoroughly discussed and related to flow of water in plant tissues and to stomatal movement. Transport of gases to and from the plant leaf is shown to be a result of turbulence coupled with inflow of radiant energy. Emphasis is placed on the interaction of plant communities and individual plant parts with the imposed climate, resulting in a plant community climate which is definable by well known physical laws. (Woodard-USGS) W72-03173

PSYCHROMETRIC METHOD OF DETERMINING WATER PRESSURE (POTENTIAL) IN SOIL AND PLANTS (PSIKHROMETRICHESKIY METOD OPREDELENIYA DAVLENIYA (POTENTSIALA) VLAGI V POCHVE I RASTENIYAKH),

Moscow State Univ. (USSR). Dept. of Soil Biology; and Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.

For primary bibliographic entry see Field 02G.

W72-03240

SOME REGULARITIES IN THE OCCURRENCE OF LEECHES (HIRUDINEA) IN THE WATERS OF THE BIALYSTOK REGION,

Bialystok Medical Academy (Poland). Dept. of Histology and Embryology.

Jozef Wilkialis.

Ekol Pol Ser A. 18 (33): 647-680. Illus. 1970. Polish summary.

Identifiers: Bialystok, Habitat, Hirudinea, Leeches, Phenology, USSR.

A list is given of the bodies of water examined and the species of leeches collected. Analyses were made of the occurrence of leeches in waters differing as to trophic character, character of the substratum and places of attachment. Occurrence of species depended on speed of the current in rivers, wave movement in lakes, and food supply. Phenological observations for leeches are also taken into consideration.--Copyright 1971, Biological Abstracts, Inc. W72-03284

ECOLOGY OF GASTROPODA IN A SOUTH AFRICAN MAN-GROVE SWAMP, British Museum of Natural History, London.

D. S. Brown.

Proc Malacol Soc London. 39 (4): 263-279. Illus. 1971.

Identifiers: African, Assiminea-Bifasciata, Auriculastra-Radiolata, Cassidula-Labrella, Cerithiidae-Decollata, Distribution, Ecology, Gastropoda, Mangrove, Melampus-Semiaratus, Neritina-Natalensis, Relations, South, Swamp, Trophic.

Forty-four quadrat samples were taken along 3 transects through a South African mangrove swamp in order to study the distributions of gastropod snails. Quantitative observations are presented for *Neritina natalensis*, *Assiminea bifasciata*, *Cerithiidae decollata*, *Melampus semiaratus*, *Cassidula labrella*, *Auriculastra radiolata*. Distributions showed horizontal zonation in relation to a creek, though several species occurred together in many quadrats. Densities varied locally in relation to the texture and moisture content of the substratum, and the degree of shading. With the exception of *Cerithiidae decollata*, snails were found almost exclusively on or within the substratum. Resting individuals of *C. decollata* formed dense aggregations on tree trunks and observations on marked snails suggested that feeding took place on the mud surface in an activity cycle related to spring tides. Some aspects of trophic relations are discussed.--Copyright 1971, Biological Abstracts, Inc. W72-03289

THE ECOLOGY OF SMALL MAMMALS AT SARATOGA SPRINGS, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA, Nevada Univ., Las Vegas.

W. Glen Bradley, and James E. Deacon. J Ariz Acad Sci. 6 (3): 206-215. Illus. 1971. Identifiers: Antrozous-Pallidus, California, Death, Dipodomys-Deserti, Ecology, Mammals, Monument, National, Neotoma-Lepida, Pipistrellus-Hesperus, Reithrodontomys-Megalotis, Saratoga, Spemophilus-Tereticaudus, Springs, Valley.

The rodents of Saratoga Springs and adjacent habitats were trapped from Nov. 1965 through March 1967. Data on ecological distribution, relative and seasonal abundance, population structure, reproduction, and food habits are presented. Bats were collected in mist nets and observations were made of the larger mammalian species. Of the 6 spp. of bats collected, 2 spp., Antrozous pallidus and Pipistrellus hesperus, are abundant and active for most of the year. Ten spp. of rodents, all of which are found in desert habitats, were collected. Several of these, including Spemophilus tereticaudus, Dipodomys deserti, Reithrodontomys megalotis, and Neotoma lepida had their greatest relative abundance within the more mesic sand dunes or marsh habitats. It appears that most species collected during this study are able to maintain maximum population density in the more mesic habitats where water, food (especially green vegetation), and shelter are more available. There is some evidence to suggest a more prolonged reproductive season correlated with increased utilization of green vegetation as food. Further investigations comparing reproduction and food habits between arid and mesic populations would be of value.—Copyright 1971, Biological Abstracts, Inc. W72-03306

SOILS AS COMPONENTS OF ECOSYSTEMS, Oak Ridge National Lab. Tenn. Ecological Sciences Div. M. Witkamp.

In: Annual Review of Ecology and Systematics; Annual Reviews Inc.; Palo Alto, California, p 85-110, 1971.

Descriptors: *Soil-water-plant relationships, *Fallout, *Cycling nutrients, Ecosystems, Rain forests, Mathematical models, Linear programming, Systems analysis, Deciduous forests, Decomposing organic material, Fertility, Rhizosphere, Root systems, Soil fungi, Soil environment, Soil temperature, Soil chemical properties, Soil bacteria, Soil algae.

Mineral cycling literature of the last 2-3 years is reviewed to provide insight into driving forces and rates of transfer, as well as the importance of the various pathways. Biota are the prime agents in maintaining productivity which is often limited by mineral availability and is dependent on recycling through plant and animal debris. Much of the internal turnover in subsystems can be treated as black boxes by considering only turnover rates and pool size. Turnover times in a tropical rain forest calculated as total pool/turnover rate vary from 0.08 yr for K to 133 yr for N, and decrease in the order Mg, Ca, H, C, Mn, Na and P. A large P influx stems from rain. Inputs of sodium and chlorine by rain depend to a large extent on oceanic storms that transport spray far inland. Similarly, about half of the potassium input is in rain. The potassium input is only about 1% of that recycled. Efficient recycling accounts for the lower nutrient requirements with forests as compared to agriculture. Microbial activity, and consequently remineralization if temperature dependent. Interruption of mineralization during winter may allow loss of nutrients by leaching. Low rates of evaporation and resulting anaerobic conditions also tend to inhibit mineralization. (Bopp-ORNL) W72-03342

STUDY OF ZOSTERA, LANICE AND SABELLIDAE IN THE DINARD REGION, Paris Univ., Rennes (France). Faculte des Sciences.

Marie-Therese Olivier. Tethys. 1 (4): 1097-1138. Illus. 1969. English summary. Identifiers: Competition, Dinard, Feeding, France, Lamellibranchia, Lanice, Phanerogams, Polychaeta, Sabellidae, Zostera-M.

The infauna of Zostera beds is made up of species living in sandy and muddy soils, and belonging for the most part to Polychaeta and Lamellibranchia. The qualitative composition presents no special peculiarities when compared with the macrofauna of muddy infralittoral sands devoid of phanerogams. The existence of facies is accounted for by the study of local edaphic factors, some of which were modified by the building of a dam over the Rance (river), which favored increase of some species. Feeding competition between the species was observed and sets the problem of stability of the facies.—Copyright 1971, Biological Abstracts, Inc. W72-03398

SUN AND SHADE TOLERANCE IN THE ECOPHYSIOLOGY OF SOLANUM SURATENSE BURM, Jodhpur Univ. (India). Dept. of Botany.

Keshav D. Sharma, and David N. Sen. Z Pflanzenphysiol. 64 (3): 263-266. Illus. 1971. Identifiers: Chlorophyll, Eco, Moisture, Nitrogen, Number, Physiology, Reducing, Shade, Solanum-Suratense-D, Stomata, Sugars, Sun, Tolerance.

Some ecophysiological indices were studied in 2 groups of sun and shade tolerant plants of Solanum suratense. The influence of sun and shade on the moisture content, chlorophyll content, total N, total reducing sugars and the number of stomata on both surfaces was studied.—Copyright 1971, Biological Abstracts, Inc. W72-03392

THE EFFECTS OF SALINITY ON GERMINATION AND EARLY GROWTH OF PUCCINELLIA NUTTALLIANA, Ohio Univ., Athens. Dept. of Botany.

Allan J. Macke, and Irwin A. Ungar. Can J Bot. 49 (4): 515-520. Illus. 1971. Identifiers: Early, Germination, Growth, Halophyte, Photoperiod, Puccinellia-Nuttalliana-M, Salinity.

Puccinellia nuttalliana can germinate in media with a water potential to -16 bars, with a sharp decrease in germination at -12 bars. Recovery from -42 bars is generally equal to that of control tests, indicating high salinities do not permanently inhibit germination. Seedlings are stimulated at -4 bars, but growth shows a sharp decrease between -8 bars and -16 bars. Growth and flowering are promoted by long days. P. nuttalliana is not an obligate halophyte, but is tolerant of salinities which most nonhalophytes cannot endure.—Copyright 1971, Biological Abstracts, Inc. W72-03393

THE DISTRIBUTION OF DRY MATTER GROWTH BETWEEN SHOOT AND ROOTS IN LOBLOLLY PINE, Yale Univ., New Haven, Conn. School of Forestry.

F. Thomas Ledig, F. Herbert Bormann, and Karl F. Wenger. Bot Gaz. 131 (4): 349-359. Illus. 1970. Identifiers: Allometric, Distribution, Dry, Growth, Light, Loblolly, Matter, Moisture, Pine-G, Pinus-Taeda-G, Relationship, Roots, Shoot, Soil, Stress.

The allometric relationship, $\log(y) = a + k \cdot \log(x)$; where x is one plant organ (e.g., dry weight of roots) and y is another (e.g., dry weight of shoot);

was used to study the relative distribution of growth within loblolly pine (Pinus taeda) seedlings. The relative distribution of growth between shoot and roots or among needles, stem, and roots was unchanged by conditions ranging from full sunlight to 1/3 of full sunlight. There was an indication that the growth of the shoot was inhibited by soil moisture stress to a relatively greater degree than the growth of the roots, as shown by a decrease in slope of the allometric relationship. These results and data reanalyzed from the literature suggested that the relative growth of shoot to root in pine is surprisingly constant under the usual conditions of culture. The ontogenetic decrease in the ratio of shoot to root seems to be a common trend in woody seedlings, and this pattern can be interpreted as adaptive.—Copyright 1971, Biological Abstracts, Inc. W72-03398

CHANGE OF THE ACTIVITY PHASE OF UNICELLULAR ALGAE IN FLOWING WATER, Agnes Muller-Haeckel.

Oikos. Suppl. (13): 134-138. Illus. 1970 English and Russian summary. Identifiers: Algae, Flowing, Monoraphidium, Phase, Thalassiosira-Fluviatilis, Unicellular.

The drift patterns of 1 green alga (Monoraphidium) and 1 diatom (Thalassiosira fluviatilis) revealed phase shifting. The algal populations shifted their activity peaks synchronously.—Copyright 1971, Biological Abstracts, Inc. W72-03399

MEASUREMENT OF THE DAILY PERIODICITY OF COLONIZATION OF ALGA CELLS IN FLOWING WATER, Agnes Muller-Haeckel.

Oikos. Suppl. (13): 14-20. Illus. 1970 English and Russian summary. Identifiers: Alga, Cells, Colonization, Daily, Flowing, Measurement, Periodicity.

The colonization by drifting algae represents a truly active process. Certain differences in the timing of drift and colonization maxima were recorded. An apparatus for automatic sampling of the colonization was devised. The colonization is a phenomenon lending itself to accurate examination of diel and annual activity patterns.—Copyright 1971, Biological Abstracts, Inc. W72-03400

SUCCESSIONS OF THE VEGETATION IN RIVER FLOODPLAINS. (CLASSIFICATION OF SUCCESSIONS AND THE MAIN TRENDS OF STATISTICAL ANALYSIS), Bashkir State Univ., Ufa (USSR).

B. M. Mirkina. Bot Zh. 55 (10): 1405-1418. Illus. 1970 English summary. Identifiers: Analyses, Classification, Climax, Cyclic, Floodplains, Gradient, Humus, Mono, Poly, River, Salinity, Statistical, Successions, Trends, Vegetation.

The nature of floodplain succession (monoclimax, polyclimax, cyclic) is discussed. A statistical analysis of a large random sample is presented. Gradient analyses with a time axis, humus content ordinate and salinization coordinate are considered. A method of interspecific covariation is given.—Copyright 1971, Biological Abstracts, Inc. W72-03403

IN SITU EXPERIMENTS ON THE CELL REPRODUCTION OF SCENEDESMUS OBLIQUUS IN RUNNING WATERS: I. ANNUAL CYCLE, Jena Univ. (East Germany). Sektion Biol.

Wolfram Braune. Limnologica. 7 (2): 371-376. 1970. Identifiers: Annual, Cell, Cycle, Phosphorus, Reproduction, Running, Scenedesmus-Obliguus.

Field 02—WATER CYCLE

Group 21—Water in Plants

The reproduction of *Scenedesmus obliquus* found in the Saale River above and below Jena (Germany) in 1965/1966 was studied using permeable capsules in situ under biotope-like conditions. The highest growth rate is in May and July. Cell reproduction in the waters above Jena was always higher than that below the city. Parallel investigations were made on the reproduction of *Scenedesmus* within the natural populations in flowing water. Reproduction was lower in these cases. Assuming similar physiological activity in June and July of 1966 *Scenedesmus* cells transported freely in the river and those in permeable capsules eliminated 52-96.4 micro g and 7.8-14.5 micro g P from the upper 10 cm of a 1 m wide cross section of the river in 24 hr. This was calculated from nutrient incorporation.--Copyright 1971, Biological Abstracts, Inc.

W72-03404

IN SITU EXPERIMENTS ON CELL REPRODUCTION OF SCENEDESMUS OBLIQUUS IN RUNNING WATERS: II. VERTICAL PROFILE.
Jena Univ. (East Germany). Sektion Biol. Wolfram Braune.
Limnologia. 7 (2): 377-380. Illus. 1970.
Identifiers: Cell, Germany, Light, Profile, Reproduction, River, Running, Saale, *Scenedesmus-Obliquus*, Vertical.

With in situ cultures (*Scenedesmus obliquus* in membrane filter capsules) algae reproduction was determined in the Saale River above Jena (Germany) to a depth of 1.4-1.8 m. This depth corresponds to from 1.4 to 4% of the surface light. The highest growth rate was observed at a depth of 40 cm.--Copyright 1971, Biological Abstracts, Inc.

W72-03405

PLANT SOCIETIES IN THE STECHLIN LAKE AREA. V. FORESTS, HEDGES AND PERIPHERAL SOCIETIES.
Deutsche Akademie der Wissenschaften zu Berlin (East Germany). Forschungsstelle fuer Limnologie.
Heinz-Dieter Krausch.
Limnologia. 7 (2): 397-454. Illus. 1970.
Identifiers: Beech-D, Conifers-G, Forests, Germany, Hedges, Hornbeam-D, Lake, Marsh, Oak-D, Peripheral, Plant, Shrubs, Societies, Stechlin.

The lakes and marshes of the Stechlin lake complex are embedded in a wooded area. Woods exert a decisive influence on the local climate and on the biocenosis, and the plant societies of the Stechlin lake area among which aquatic and marsh societies predominate also include forest societies. Weeds are subordinate. The history of the Stechlin lake area forests, the coniferous forest societies, the acidophilic mixed oak and beech forest societies, deciduous mixed forest societies, mixed beech forest societies, oak-hornbeam societies, hedge and shrub societies, perennial peripheral shrub societies and societies growing on clearings are described.--Copyright 1971, Biological Abstracts, Inc.

W72-03406

VARIATIONS IN THE WATER USE OF SOME PLANTS OF THE BLACK SEA COAST AS A FUNCTION OF THEIR AGE.
Elena Jeanrenaud.
An Stiint Univ Al I Cuza Iasi Sect II a Biol. 15 (2): 263-277. Illus. 1969.
Identifiers: Absorption, Age, Anchusa-D, Black, Coast, Ecballium-D, Function, Inula-D, Marrubium-D, Plants, Retention, Sea, Teucrium-Chamaedrys-D, Transpiration, Variations.

Age determines the percentage of decrease of water used in these plants and leaf water retention. This indicates a decrease in hydrophilia, and thus of the protoplasm colloidal energy as the plants age. Unfavorable humidity and temperature conditions in the spring and early summer of 1968 accelerated the aging process. In *Teucrium chamaed-*

rys, although the percentage of water in the plant is reduced, the water retention capacity of the leaves remains high due to an increase in osmotic ability and a cuticle thickening. The water content decreases from May to July; the most marked decrease is observed in *Inula* and *Teucrium*, in which the greatest reduction in water content was recorded. Transpiration decreased in all the plants, except for *Inula*. The water deficit increases as the plants mature, which indicates a decrease in water absorption capacity parallel with age. Young leaves, which appeared to be in more adverse humidity and temperature conditions (*Ecballium*) also maintain a high degree of hydrophilia and a high water retention capacity in July. Age changes the daily rhythm of transpiration for *Anchusa* (in May the curve is unimodal and in July, bimodal). In the other plants, the transpiration curve kept the same character before and after blooming (bimodal in *Inula* and *Teucrium* and 1 maximum in *Ecballium* and *Marrubium*).--Copyright 1971, Biological Abstracts, Inc.

W72-03408

SPHAGNUM OF THE AMERICAN MOUNTAIN PLATEAU REGION (FRANCE): PHYTOGEOGRAPHICAL AND ECOLOGICAL RESEARCH.
Jean Touffet.
Bot Rhedonica Ser A. 6: 14-357. Illus. Maps. 1969.
Identifiers: Acidity, American, Ecological, France, Geographical, Humidity, Light, Mountain, Phyto, Plateau, Sphagnum, Succession, Temperature.

Transplant studies were done. General appearance and coloration were related to station conditions. Cauline leaf form, pore distribution, and hyalodermis were stable enough to distinguish the taxa. The analysis of different turficolous groups showed a relatively varied peat bog vegetation. There were 8 groups corresponding to ecological modifications. Examination of the succession indicated 2 possible developmental series. Sphagnum distribution is closely correlated with variations in nature and water content of the substrate, temperature, light and atmospheric humidity on the surface of the sphagnum. Distribution appears to especially depend upon nutrition and the degree of substrate humidity. The ecological behavior and distribution of various species were explained. Water retention capacity, desiccation speed, degree of immersion, growth and propagation abilities, and ability to acidify the environment explain their natural distribution. Water acidification was studied and the role of ion exchange between sphagnum and environment were confirmed. Too much importance has been placed upon the necessity of acid water with a low mineral content for sphagnum. The plants are capable of creating conditions favorable to their development by acidifying their surroundings.--Copyright 1971, Biological Abstracts, Inc.

W72-03409

SOME ECOLOGICAL AND PHYSIOLOGICAL PECULIARITIES OF WOODY PLANTS IN CONNECTION WITH THE EFFECT OF TEMPORARY OVERMOISTENING.
A. V. Veretennikov.
Tr Inst Ekol Rast Zhivotn Ural Fil Akad Nauk SSSR. 62. 143-147. 1968. Translated from Ref Zh Otd Vyp Lesoved Lesovod, 1969, No. 3.56.53.
Identifiers: Anabiosis, Connection, Deficiency, Ecological, High, Moistening, Myrtle-D, Needle, Oxygen, Peculiarities, Physiological, Pigmentation, Plants, Soil, Spruce-G, Temperature, Whortleberry-D, Woody.

In the Belomorskii Forest Farm in the Arkhangel'sk Region, in 2 adjoining 160-yr-old myrtle whortleberry-spruce forests, one of the moist (M) site class, the other of the fairly moist (FM) site class, the effects of flooding of root-inhabited soil horizons and the resultant physiological variations in spruce were studied. In the M forest, underflooding is stable, water level not dropping below 20-40 cm even in July and Aug. In the FM

forest (the control), summer underflooding is absent. Data on the O₂ and CO₂ content in the soil water in M show that disturbance of the physiological processes in spruce is a result of O₂ deficiency (in summer-up to 0.5 mg/l, in spring and fall - 1.9 to 4.4 mg/l) rather than an excess of CO₂ which does not reach a noxious limit. The O₂ deficiency causes greatest harm at high soil temperatures. Data are given on reducing the pigmentation in spruce needles in FM in connection with a temporary anabiosis in the rhizosphere.--Copyright 1971, Biological Abstracts, Inc.

W72-03414

ANNUAL REVIEW OF ECOLOGY AND SYSTEMATICS, VOL. 1.
For primary bibliographic entry see Field 05C.

W72-03416

STUDIES ON DIFFERENT MIXTURES OF GRASSES WITH PERENNIAL LEGUME PLANTS FOR ORCHARDS: II. THE INFLUENCE OF FREQUENCY OF MOWING ON THE SOILS MOISTURE.
Instytut Sadownictwa, Skierniewice (Poland). W. Klossowski.
Pr Inst Sadownictwa Skierniewicach. 13: 109-119. Illus. 1969. Russian and English summary.
Identifiers: Festuca-Rubra-M, Frequency, Grasses-M, Legume-D, Lolium-Perenne-M, Lotus-Corniculatus-D, Matter, Mixtures, Moisture, Mowing, Nitrogen, Orchards, Organic, Perennial, Plants, Poa-Pratensis-M, Soil, Trifolium-Pratense-D, Trifolium-Repens-D.

Five different mixtures of grasses with perennial legume plants comprising the following species of grasses: perennial ryegrass (*Lolium perenne*), red fescue (*Festuca rubra*), kentucky bluegrass (*Poa pratensis*), and the following legumes: white clover (*Trifolium repens*), red cover (*T. pratense*) and birdsfoot trefoil (*Lotus corniculatus*) were tested. The presence of legumes in the sward increased the total N, but decreased the contents of organic matter in the soil. Legumes soon perished from the sward. Frequent (every 10 days) mowing of sward increased soil moisture, but on the other hand, decreased the amount of organic matter in the soil. Differences between the levels of soil moisture in the 5 sward mixtures were not significant.--Copyright 1971, Biological Abstracts, Inc.

W72-03417

EFFECTS OF SOIL MOISTURE ON GROWTH OF YOUNG TEA IN MALAWI.
University of the West Indies, St. Augustine (Trinidad). Cocoa Research Unit.
R. Fordham.
Exp Agr. 7 (2): 171-176. Illus. 1971.
Identifiers: Growth, Irrigation, Malawi, Moisture, Soil, Tea-D, West-Indies, Young.

Young tea plants were grown for 8 mo. in large polythene bags of soil, with provision to prevent rain from running into the soil. After a preliminary period of establishment, in which all plants were kept well-watered, 4 soil moisture regimes were applied ranging from watering twice weekly to withholding irrigation until plants had been subjected to a soil moisture tension of 15 bar, as determined by gypsum resistance units, for a period of 1 wk before rewatering. Plant survival and growth were significantly better under the wettest compared with the driest regime.--Copyright 1971, Biological Abstracts, Inc.

W72-03419

PROTECTION OF SNAILS AGAINST MIRACIDIA OF SCHISTOSOMA MANSONI BY VARIOUS AQUATIC INVERTEBRATES.
Harvard School of Public Health, Boston, Mass. Eli Chernin, and J. M. Perstein.
J Parasitol. 57 (2): 217-219. 1971.
Identifiers: Aquatic, Biomphalaria-Glabrata, Invertebrates, Larvae, Miracidia, Mosquito,

WATER CYCLE—Field 02

Water in Plants—Group 21

Planaria, Protection, Schistosoma-Mansoni, Snails.

In linear experimental channels, planaria and mosquito larvae protected susceptible *Biomphalaria glabrata* from infection by miracidia of *S. mansoni*. These and other studies suggest that various invertebrates may be important in regulating the frequency of trematode infections among snails in the field.—Copyright 1971, Biological Abstracts, Inc.
W72-03424

STOMATAL OPENING: THE ROLE OF ABSCISIC ACID,
Guelph Univ. (Ontario). Dept. of Botany.
Roger F. Horton.
Can J Bot. 49 (4): 583-585. 1971.
Identifiers: Abaxial, Absciscic-Acid, Adenine, Benzyl, Cells, Cyto, Epidermal, Gibberellic-Acid, Guard, Kinetin, Kinins, Leaf, Opening, Potentials, Stomatal, Strips, Vicia-Faba-D.

Absciscic acid inhibited stomatal opening in isolated abaxial epidermal strips of *Vicia faba*. Kinetin, benzyladenine, and gibberellic acid, which can enhance stomatal apertures in intact leaves, are ineffective on isolated epidermal strips. Absciscic acid appears to act directly on the guard cells, rather than by influencing water potentials throughout the leaf.—Copyright 1971, Biological Abstracts, Inc.
W72-03431

EVALUATION OF WATER STRESS CONTROL WITH POLYETHYLENE GLYCOLS BY ANALYSIS OF GUTTATION,
California Univ., Riverside. Dept. of Plant Science.
Alan N. Eckard.
Plant Physiol. 47 (4): 453-456. Illus. 1971.
Identifiers: Accumulation, Calcium, Capsicum-Frutescens-D, Control, Ethylene, Glycols, Guttation, Ions, Leaf, Magnesium, Poly, Potassium, Root, Simulation, Sodium, Soil, Stress, Xylem.

The water relations of pepper plants (*Capsicum frutescens* L.) under conditions conducive to guttation were studied to evaluate the control of plant water stress with polyethylene glycols. The addition of polyethylene glycol 6000 to the nutrient solution resulted in water relations similar to those expected in soil at the same water potentials. Specifically, xylem pressure potential in the root and leaf became more negative during a 24-hr treatment period, while osmotic potential of the root xylem sap remained constant. The decrease in pressure potential was closely correlated with the decrease in osmotic potential of the nutrient solution. In contrast, the addition of polyethylene glycol 400 to the nutrient resulted in a reduction of osmotic potential in the root xylem sap; this osmotic adjustment in the xylem was large enough to establish an osmotic gradient for entry of water and cause guttation at a nutrient solution osmotic potential of -4.8 bars. Pressure potential in the root and leaf xylem became negative only at nutrient solution osmotic potentials lower than 0.48 bars. About half of the xylem osmotic adjustment in the presence of polyethylene glycol 400 was caused by increased accumulation of K^+ , Na^+ , Ca^{2+} , and Mg^{2+} in the root xylem. These studies on polyethylene glycol 6000 are more useful for simulating soil water stress than smaller molecules such as polyethylene glycol 400.—Copyright 1971, Biological Abstracts, Inc.
W72-03433

WATER TRANSPORT FROM GAMETOPHYTE TO SPOROPHYTE IN MOSSES,
Heidelberg Univ. (West Germany). Botanical Inst.
Martin Bopp, and Hans-Peter Weniger.
Z Pflanzenphysiol. 64 (3): 190-198. Illus. 1971. English summary.
Identifiers: Gametophyte, Haustoria, Mosses, Sporogonia, Sporophyte, Transpiration, Transport, Vaginula.

Water transport from the gametophyte to the sporophyte was studied in *Funaria hygrometrica* and in some members of the family Polytrichaceae. The water in the central axis (central strand) of the gametophyte first was transported to the vaginula and then it passes on directly to the sporophyte before spreading through the gametophyte. Even after the removal of the sporophyte the water emerged in the vaginula of the gametophyte. Water flow in isolated sporogonia was slower than in sporogonia in situ. This difference became apparent only when the relative humidity of the air was low. With a relative humidity above 80%, the flow rate was equal in both. Inhibition of respiration in the gametophyte had no retarding effect on the water transport in the sporophyte. Water flow was slower in sporogonia without haustoria, than in those with intact haustoria. High osmotic pressure of the solution inhibited the water transport with or without haustoria. The results are understandable only if it is assumed that the specific structures of the vaginula wall projections discovered recently secrete a 'solution' that is most readily absorbed through the wall labyrinth of the haustorium. This ensures, at strong transpiration, a sufficiently high water transport rate in the sporophyte.—Copyright 1971, Biological Abstracts, Inc.
W72-03434

THE EFFECT OF RELATIVE HUMIDITY OF OSMOTIC-TOLERANCE OF ALKALINE AND FERTILE SOIL ASPERGILLI,
Sir George Williams Univ., Montreal (Quebec). Dept. of Biological Sciences.
M. L. Thakur.
Microbios. 3 (9): 49-53. 1971.
Identifiers: Alkaline, Aspergilli, Aspergillus-Carneus, Aspergillus-Nidulans, Aspergillus-Sclerotiorum, Aspergillus-Versicolor, Fertile, Growth, Humidity, Optima, Osmotic, Soil, Tolerance.

An ecological study was made with 4 alkaline and fertile soil species of *Aspergillus* A. versicolor (Vuill) Tiraboschi, A. carneus (Tiegh) Bloch, A. sclerotiorum Huber, and A. nidulans (Eidam) Wint, to observe the effect of controlled relative humidity (100, 95.1, 90, 85.1, 80, 75, 70, 42, 32%) on osmotic-growth optima and tolerance. A relationship between relative humidity (RH) and osmotic-tolerance was observed on the growth of alkaline and fertile soil species. The alkaline soil species were high osmotic-tolerant at low pH. The favorable RH for sporulation was from 70-80% for alkaline and 80-95.1% for fertile soil species.—Copyright 1971, Biological Abstracts, Inc.
W72-03444

DIURNAL AND SEASONAL RHYTHM OF WATER DEFICIENCY OF THE LEAVES OF SOME PHANEROPHYTES IN THEIR NATURAL HABITATS,
Mihovil Gracanin, Ljudevit Ilijanic, Valentina Gazi-Baskova, and Nada Hulina.
Acta Bot Croat. 29: 95-111. 1970.
Identifiers: Abies-Alba-G, Acer-Pseudoplatanus-D, Carpinus-Betulus-D, Corylus-Avellana-D, Deficiency, Diurnal, Fagus-Sylvatica-D, Fraxinus-Excelsior-D, Habitats, Leaves, Natural, Phanerophytes, Quercus-Petraea-D, Rhythm, Sambucus-Racemosa-D, Seasonal, Water, Yugoslavia.

The study was performed on *Abies alba*, *Corylus avellana*, *Acer pseudoplatanus*, *Fagus sylvatica*, *Quercus petraea*, *Sambucus racemosa*, *Carpinus betulus*, and *Fraxinus excelsior* in 2 areas of Yugoslavia differing in elevation and climate, the Zagreb mountains and the Zagreb-Zelengaj. The experimental phanerophytes of the Zagreb mountains had a lower water deficiency span than those of the Zelengaj region. The first fluctuated between 0 and 18.9%, the second between 0.8 and 44.1%. Water deficiency depends primarily on the plant's own ability to regulate its water balance. *Q. petraea* exhibited in both *Fagetum sylvaticae*

croaticum abietetosum and in *Quercus-Carpinetum croaticum erythrometosum* the lowest diurnal water deficiency levels and amplitudes. Differences in water deficiency levels of the same plant in 2 different locations point to the role of external factors especially the water factor. Some diurnal rhythm was found.—Copyright 1971, Biological Abstracts, Inc.
W72-03461

COMPARATIVE HYDROECOLOGICAL STUDY OF SOME FESTUCA SPECIES, (IN RUSSIAN),
Leningrad State Pedagogical Inst. (USSR).
G. N. Solon'ko.
Dokl Akad Nauk Beloruss SSR. 14 (5): 468-470. 1970.
Identifiers: Adaptations, Comparative, Ecological, Festuca-Gigantea-M, Festuca-M, Festuca-Ovina-M, Festuca-Pratensis-M, Festuca-Rubra-M, Festuca-Sulcata-M, Hydro, Species, Transpiration, Xerophytic.

Five *Festuca* spp. that are xerophilic to different degrees were studied: *F. gigantea*, a eumesophyte, *F. pratensis*, a mesophyte, *F. rubra*, a xeromesophyte, and *F. ovina* and *F. sulcata*, hemixerophytes. Investigations conducted in different natural zones showed that in these species there is a rather clear gradual reduction in the evaporating surface, transpiration diminishes and the growing period is shortened. The biological significance of these adaptive changes, which are directed at reducing the amount of moisture used up by the plants for evaporation, is extremely great and requires further study.—Copyright 1971, Biological Abstracts, Inc.
W72-03466

DAILY AND ANNUAL PERIODICITY OF THE DRIFT IN FLOWING WATERS IN DIFFERENT LATITUDES,
Karl Muller.
Oikos. Suppl. (13): 21-44. Illus. 1970. English and Russian summaries.
Identifiers: Annual, Daily, Drift, Ephemeroptera, Flowing, Latitudes, Periodicity, Photoperiodicity, Plecoptera, Simuliidae.

The bigenism and alternans activity patterns occur in both day and night active animals at different latitudes. The time cue invariably is the light-dark change. The reaction of invertebrates on the long photoperiods of high latitudes is very different: certain Ephemeroptera, are desynchronized for a short period or only partially. Plecoptera for over 1 mo., and larvae of Simuliidae for half a year. The seasonal differences in drifting quantities are correlated with life history phenomena, and the significance of drift should be analyzed on this background.—Copyright 1971, Biological Abstracts, Inc.
W72-03467

ON THE ECOLOGY OF THE SAND SHRIMP, CRANGON AFFINIS DE HAAN, AS A PREY OF THE DEMERSAL FISHES IN SENDAI BAY,
Tokai Univ., Tokyo (Japan). Coll. of Marine Science and Technology.
Masaya Kosaka.
J Coll Mar Sci Technol Tokai Univ. 4: 59-80. Illus. Maps. 1970. In Japanese with English summary.
Identifiers: Bay, Crangon-Affinis, Demersal, Distribution, Ecology, Fishes, Japan, Prey, Sand, Sendai, Shrimp, Spawning.

Spawning season, feeding habits, distribution and fish predator species are given.—Copyright 1971, Biological Abstracts, Inc.
W72-03469

TISSUE WATER RELATIONS OF SOME WOODY SPECIES OF THE ACCRA PLAINS, GHANA,
Ghana Univ., Legon. Dept. of Botany.
D. U. U. Okali.

Field 02—WATER CYCLE

Group 21—Water in Plants

Identifiers: Accra, Allophylus-Africanus-D, Azadirachta-IndicatD, Capparis-Erythrocarpos-D, Clausena-Anisata-D, Closure, Desiccation, Dichapetalum-Guineense-D, Drought, Fagara-Zanthoxyloides-D, Flacourtia-Flavescens-D, Ghana, Plains, Relations, Resistance, Securinega-Virosa-D, Species, Stomatal, Tissue.

Some aspects of the drought resistance of 8 woody species growing together in a clump on the Accra Plains were studied with the object of obtaining comparative data on mechanisms of adaptation to drought. The curves relating relative water content to water potential of leaf tissue were found to be similar for 5 of the species: Fagara zanthoxyloides, Dichapetalum guineense, Securinega virosa, Allophylus africanus and Azadirachta indica. Similar curves for Capparis erythrocarpos, Flacourtia favesces and Clausena anisata differed significantly from the others and on this basis Capparis appeared to be the most resistant to drought. Visual estimates of the critical levels of leaf water status for tissue damage also indicated that Capparis was the most tolerant to desiccation, while Securinega was among the least tolerant. Comparison of stomatal responses to desiccation however showed that Securinega rather than Capparis was the least sensitive of the species studied. The relative water content at which stomata closed in Securinega was significantly lower than that for the other species. Dichapetalum and Capparis had the highest stomatal closure relative water content. The results emphasize the diversity in mechanisms of adaptation to drought which may be shown by species growing together in the same environment, and further show that even within the same tissue adaptation to drought may proceed along several lines which may not necessarily be compensatory.—Copyright 1971, Biological Abstracts, Inc. W72-03487

FISHERIES AND FISH CULTURE IN ISRAEL IN 1968,

Laboratory for Research Fish. Dis., Nir Dawid (Israel). S. Sarig. Bamidgch. 21 (4): 95-113. Illus. 1969. Identifiers: Canning, Carp, Culture, Fish, Fisheries, Israel, Mullet, Pond, Tilapia, Yield.

The year 1968 was one of the most productive yr for the Israeli fishery both with respect to catches and per-capita consumption. The total catch was 19% higher and the per-capita consumption 3% higher than in 1967. The portion of imported fish in the per-capita consumption decreased by 2.5% with respect to 1967. The deep-sea and tuna catches decreased by 0.5% and local fishery and fish culture yielded 3% more. The use of 'live, fresh and frozen' fish in the per-capita consumption rose from 73% (in 1967) to 75%. The portion of Mediterranean and Red seas catches rose by 9.2% compared to 1966 and 6.7% compared to 1967. The Lake Kinnereth catch did not change, but the portion of choice fish (all species except bleak) rose from 36% in 1967 to 43%. The trend in increased catches of mullet in Lake Kinnereth continued and reached 13.6% of the total catch as compared to only 4.3% in 1965. Canned fish increased by 17.5%, although imported raw material for canning decreased by 1.5%. For the 1st time, carp was canned, and represented 6.5% of the total canned fish. The carp were prepared as 'gefilte fish' mainly for export. Compared to the 2 previous years, a distinct change occurred in pond fish consumption, especially of carp. In this year, 1392 more tons of pond fish were marketed than in 1967. The average yield of pond fish reached 2120 kg/ha as compared to 1760 kg/ha in 1967. A sharp rise occurred in marketing of supplementary pond fish/tilapia and mullet—reaching a total of 1528 tons as opposed to 1025 tons in 1967. Supplementary fish represent 15% of total pond fish yield. Tilapia and, especially, mullet were marketed throughout the year. Only during 4 mo. in spring was tilapia supply inadequate to meet the demand. Over 69% of all tilapias and 60% of all mullets marketed were

from pond culture. About 43% of pond culture area yielded 2000-3000 kg/ha. In 8.7% of the pond area, yields were over 3000 kg/ha, while 9% of the area gave less than 1500 kg/ha. The 10 fish farms, giving yields of over 3000 kg/ha covered a pond area of over 400 ha with average yields of 3300 kg/ha.—Copyright 1971, Biological Abstracts, Inc. W72-03489

2J. Erosion and Sedimentation

SEDIMENT TRANSPORT BY STREAMS IN THE CHEHALIS RIVER BASIN, WASHINGTON, OCTOBER 1961 TO SEPTEMBER 1965, Geological Survey, Washington, D.C.

P. A. Giancy. Available from Sup Doc, GPO, Washington, D.C. 20402 - Price \$1.00. Geological Survey Water-Supply Paper 1798-H, 1971. 53 p, 13 fig, 2 plate, 8 tab, 17 ref.

Descriptors: *Sediment transport, *Streamflow, *Suspended load, *Small watersheds, *Washington, Hydrologic data, Data collections, Runoff, Sedimentation, Sediment yield, Particle size, Flow rates, Sediment discharge, Erosion. Identifiers: *Chehalis River basin (Wash).

The Chehalis River of southwestern Washington drains an area of about 2,100 square miles of which 1,813 square miles are in the study area. The average annual suspended-sediment discharge during the study period (water years 1962-65) was about 540,000 tons; annual loads ranged from 270,000 to 690,000 tons. About 74% of the suspended-sediment discharge was derived from the Satsop and Wynoochee River drainage basins which together cover about 450 square miles. Only about 24% was carried by the Chehalis River past Porter where the drainage area is 1,194 square miles. Estimated average annual suspended-sediment yield from tributary basins ranged from 20 to 1,500 tons per square mile. Most sediment transported in the basin originates from channel erosion which occurs mostly during storm runoff. During the study period, 90% of the suspended-sediment discharge occurred only 5-10% of the time at head-water sampling sites and 15-20% of the time at the lower main-stem stations. Sediment concentrations ranged from less than 1 milligram per liter to 1,220 milligrams per liter. (Woodard-USGS) W72-02955

LATE WEICHSELIAN POTHOLE NEAR WOLVERHAMPTON, ENGLAND, Birmingham Univ. (England). Dept. of Geology. For primary bibliographic entry see Field 02C. W72-02965

HYDROLOGY AND SEDIMENTOLOGY OF THE CHATEAU RIVER (KERGUELEN ARCHIPELAGO), Leopold Berthois, and Christian Le Provost. C R Hebd Seances Acad Sci Ser D Sci Natur (Paris). 271 (25): 2266-2268. Illus. Maps. 1970. Identifiers: Archipelago, Chateau, Hydrology, Kerguelen, Minerals, River, Sedimentology.

Studies were made on the flow of the Chateau River during periods of rising, principal cations in solution in the water, and the minerals capable of furnishing these cations. Chemical alterations were less evident than in the water currents of temperate regions, and significant disparities existed between the minerals transported in suspension and the estuary deposits indicating 2 different sedimentary basins with a common source.—Copyright 1971, Biological Abstracts, Inc. W72-03052

PROCESSES AND HISTORY OF TERMINOS LAGOON, MEXICO, Scripps Institution of Oceanography, San Diego, Calif. For primary bibliographic entry see Field 02H.

W72-03069

EROSION OF TUARES SOILS IN ALGERIA (OSOBENNOSTI EROZII POCHV TUARES V ALZHIRE), Tadzhik Scientific Research Inst. of Soil Science, Dushambe (USSR). S. P. Lomov. Pochvovedeniye, No 3, p 122-129, March 1971. 2 fig, 1 tab, 15 ref.

Descriptors: *Soil erosion, *Gully erosion, *Erosion control, *Land reclamation, Topography, Gullies, Slopes, Surface runoff, Soil profiles, Soil properties, Humus, Carbonates. Identifiers: *USSR, *Algeria, *Water erosion.

The Tuares soils of Algeria are developed primarily on marine Miocene marl and are confined to depressions of the macorelief. The soils are subjected to three types of water erosion: (1) horizontal or planar; (2) vertical or internal; and (3) linear or gully. The degree to which the soils are eroded can be determined by the color of their profile and by their humus and carbonate contents. Specific recommendations are given for controlling horizontal erosion under different conditions of soil and slope, as it is the most powerful and destructive erosion factor on these lands. (Jeferson-USGS) W72-03071

COASTAL ENGINEERING - 1970 PROCEEDINGS. For primary bibliographic entry see Field 08B. W72-03078

BOTTOM BOUNDARY SHEAR STRESSES ON A MODEL BEACH, Louisiana State Univ., Baton Rouge. Dept. of Geology, and Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 08B. W72-03094

IMPULSE WAVES GENERATED BY LANDSLIDES, Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering. For primary bibliographic entry see Field 08B. W72-03112

EROSION CONTROL IN THE TORONTO AREA, Toronto Harbor Commissioners (Ontario). For primary bibliographic entry see Field 02H. W72-03118

DEGLACIATION AND PROGLACIAL DRAINAGE: NORTH BAY-MATTAWA REGION, ONTARIO, Syracuse Univ., N.Y. Dept. of Geology. For primary bibliographic entry see Field 02H. W72-03119

MIXED-POPULATION SEDIMENT IN NEARSHORE ENVIRONMENTS, United States Lake Survey, Detroit, Mich. For primary bibliographic entry see Field 02H. W72-03120

NUMERICAL TECHNIQUES APPLIED TO PARTICLE DEPOSITION DURING SLOT FLOW, Arkansas Univ., Fayetteville. Water Resources Research Center. T. W. Copenhaver, and R. E. Babcock. Arkansas Water Resources Research Center Research Report, 1971. 25 p, 9 fig, 1 tab, 9 ref. OWRB B-004-ARK (2).

Descriptors: *Sedimentation, *Solid wastes, *Particle size, *Mathematical models, Numerical anal-

ysis, Computer programs, Systems analysis, *Waste disposal, Input-output analysis, Sands, Oil industry, Model studies.

A mathematical model presents the process of particle sedimentation from a fluid-solid slurry while flowing through a vertical slot. The differential equations describing the process consist of a 1st order, nonlinear, partial differential equation and a 1st order, ordinary differential equation. These two equations are solved using a forward difference technique and a modified method of characteristics technique. Results for typical sets of system parameters are presented and discussed. No attempt was made to determine which technique was preferred. The model finds practical application to solid-waste disposal processes and to petroleum reservoir stimulation processes. (Woodard-USGS)
W72-03154

TURBIDITES OF THE HATTERAS AND SOHM ABYSSAL PLAINS, WESTERN NORTH ATLANTIC,

Lamont-Doherty Geological Observatory, Palisades, N. Y.
D. R. Horn, M. Ewing, B. M. Horn, and M. N. Delach.
Marine Geology, Vol 11, No 5, p 287-323, December 1971. 9 fig, 1 tab, 50 ref.

Descriptors: *Turbidity, *Colloids, *Sediment transport, *Turbidity currents, *Atlantic Ocean, Sediment distribution, Particle size, Sands, Water circulation, Physical properties.
Identifiers: *Hatteras Abyssal Plain, *Sohm Abyssal Plain.

The distribution, thickness and textural properties of turbidites off the east coast of the United States are defined including results of 195 granulometric analyses of turbidite layers. Properties of deep-sea sands within a single basin are functions of availability of sediment and physiographic setting. In the Hatteras Abyssal Plain turbidity-current activity has been at a moderate level, there are no obstructions to flow, and sediment patterns are well-defined. Increasing distance from main route of flow (laterally and downcurrent) is matched by decrease in mean grain size, maximum particle size, range and thickness of units. Muddy sands are restricted to areas off the ends of submarine canyons and along principal avenues across the plain. The situation of the Sohm Abyssal Plain is different in that there has been an ample supply of sediment, more vigorous turbidity-current activity, seaward flow has been obstructed by many seamounts and seamounts, and the overall result is a haphazard dispersal of sand by bottom-seeking flows. (Woodard-USGS)
W72-03156

UNDERWATER TIME-LAPSE MOTION PICTURE SYSTEMS,

University of Southern California, Los Angeles. Dept. of Geological Sciences.
H. J. Summers, H. D. Palmer, and R. O. Stone.
Marine Geology, Vol 11, No 5, p M51-M58, December 1971. 5 fig, 8 ref. ONR Contract N0004-67-0269-0002.

Descriptors: *Sediment transport, *Oceans, *Remote sensing, *Cameras, Photography, Methodology, Sediment distribution, Tidal effects, Sedimentation rates.
Identifiers: Motion picture cameras.

Application of underwater time-lapse motion picture cameras to the study of sediment transport phenomena provides an economical and quantitative tool for the investigation of sea floor processes. Two camera systems are described, one can be operated on the ocean bottom from a pier, boat or float and the second is completely self-contained, self-powered and divorced from surface support. Time-lapse photography was used to determine growth rates of scour pit

development, migration of organisms, ripple crest advance and sediment dispersal patterns. Sea floor modification over several tidal cycles also was monitored with the self-contained unit for 47 hours of continuous activity. (Woodard-USGS)
W72-03157

THE 1967 ALTUS RESERVOIR SEDIMENT SURVEY,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
J. M. Lara.
Available from NTIS, Springfield, Va, 22151 as PB-201 633, \$3.00 in paper copy, \$0.95 in microfiche. Bureau of Reclamation Research Center Report REC-ERC-71-21, March 1971. 41 p, 52 fig, 4 tab, 5 ref.

Descriptors: *Reservoir silting, *Sedimentation, *Sediment yield, *Sediment distribution, *Oklahoma, Sedimentation rates, Post-impoundment, Reservoir stages, Surveys, Sedimentology, Particle size, Data collections, Sounding.
Identifiers: *Altus Reservoir (Okla).

Data were collected in 1967 to compute the latest capacity for the Altus Reservoir on the North Fork of Red River about 18 miles north of Altus, Oklahoma. The data were also used to compute the quantity of sediments accumulating in the reservoir since the dam was closed in 1940. Capacity of the reservoir is 134,000 acre-ft and the surface area 6,260 acres at spillway crest elevation 1559 ft. Sediments accumulated in the reservoir at an annual rate of 838 acre-ft between 1940 and 1947. Thirty sediment samples of reservoir deposits were collected from 23 reservoir range sites. An average unit weight of 70 lb/cu ft was determined from analyses of samples collected during the 1948, 1953, and 1967 surveys. Particle size analyses of these samples indicated an average breakdown of 29% clay, 32% silt, and 39% sand. Sonic depth recording mechanism was used to run the hydrographic survey. Computations for reservoir capacity were based on area determined by a width ratio method. Sediments have deposited longitudinally to depths of 1 to 9 ft and from 1 to 6 ft laterally. (Woodard-USGS)
W72-03158

RELATION OF RAINFALL ENERGY AND STREAMFLOW TO SEDIMENT YIELD FROM SMALL AND LARGE WATERSHEDS,

Agricultural Research Service, Coshocton, Ohio.
J. L. McGuinness, L. L. Harrold, and W. M. Edwards.
Journal of Soil and Water Conservation, Vol 26, No 6, p 233-235, November-December 1971. 2 fig, 6 ref.

Descriptors: *Sediment transport, *Streamflow, *Sediment yield, *Rainfall-runoff relationships, Watersheds (Basins), Small watersheds, Large watersheds, Topography, Vegetation, Suspended load.
Identifiers: *Rainfall-streamflow-sediment relationship.

Sediment yield measured from 1- and 2-acre agricultural watersheds largely was a function of rainfall energy, rainfall intensity, and crop cover characteristics. Suspended-sediment yield from a 6,000-square-mile watershed primarily was a function of the transport capacity of streamflow. The temporal patterns of sediment yield and suspended-sediment yield are distinctly different on the different sized areas. The energy-intensity parameter devised by Wischmeier from plot data seems valid for calculating the sediment yield from small watersheds. (Woodard-USGS)
W72-03159

SEDIMENTATION IN THE MIDDLE FORK EEL RIVER BASIN, CALIFORNIA,

Geological Survey, Menlo Park, Calif. Water Resources Div.
J. M. Knott.

Geological Survey Open-file Report, June 11, 1971. 60 p, 38 fig, 16 tab, 25 ref.

Descriptors: *Sedimentation, *Reservoirs, *Sediment transport, *Sedimentation rates, *Sediment distribution, California, Sediment yield, Reservoir silting, Streamflow, Watershed management.
Identifiers: *Middle Fork Eel River basin (Calif), *Dos Rios Reservoir (Calif).

Suspended-sediment data collected from 1956 to 1968 show that the quantity of sediment transported by streams in the Middle Fork Eel River basin in California is extremely variable. Annual suspended-sediment discharge for the Middle Fork Eel River near Dos Rios (proposed Dos Rios damsite) ranged from 777 to 25,100 tons per square mile. Sediment inflow to the proposed Dos Rios Reservoir would be about 2,140,000 tons or 1,570 acre-feet per year using an average unit weight of 62 pounds per cubic foot. Average composition of deposited sediment would be about 43% clay, 34% silt, and 23% sand and gravel. Most of the sediment deposited in the large Dos Rios Reservoir during the first 100 years of operation would be distributed in elevations of the reservoir above the 1,350-foot level. Sediment would occupy less than 10% of the original reservoir capacity above the 1,200-foot level and would reduce the capacity of the entire reservoir 2.1%. Sediment would accumulate to a depth of about 15 feet behind the dam and sediment distribution within the reservoir would be relatively unchanged. (Woodard-USGS)
W72-03163

STRUCTURE AND FORMATION OF COASTAL BOTTOM PLACERS IN THE EASTERN BALTIC,

Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
V. L. Boldyrev, Yu. D. Shuyskiy, and B. V. Kochetkov.
Oceanology (USSR), Vol 11, No 2, p 200-209, November 1971. 4 fig, 2 tab, 21 ref.

Descriptors: *Placer mining, *Deposition (Sediments), *Bottom sediments, *Mineralogy, Hydrodynamics, Sands, Silts, Slopes, Shores, Beaches, Dunes, Waves (Water), Currents (Water), Storms, Settling velocity, Flow rates, Glacial drift.
Identifiers: *USSR, *Baltic Sea, *Placers, Ridges, Rises, Flow velocity.

Comprehensive investigations of bottom placers along a stretch of the East Baltic coast between Liepaja and Svetoj (Latvian SSR) reveal morphological differences between them and placers of similar origin in other sea basins. The unique features of the Baltic placers are: (1) the occurrence of placers on the underwater slope; (2) their confinement to depths of 3-8 m; (3) the absence of heavy-mineral concentrates at the contact between the sedimentary mantle and the beach; and (4) the thinning out of placer bodies with depth in the bottom sediments. Contrary to popular belief, glacial deposits are the source of these economic minerals. The nature of the parent materials and the hydrodynamic regime of the eastern Baltic favor the formation of placers in areas of sediment deposition. The principal factors responsible for placer formation are the relative independence of underwater slope zones in terms of their hydrodynamic and lithodynamic regimes; the localization of silt material between depths of 3 and 8 m; and, hence, the concentration here of heavy minerals, since there is a direct relationship between the silt content in the sediments and the presence of heavy minerals. Generally, coastal-bottom placers of the eastern Baltic are recent mobile formations, confined to the upper sediment layer reworked by waves and currents. (Josefson-USGS)
W72-03246

SEDIMENT STUDY AT KARACHI BY MEANS OF RADIOACTIVE TRACERS,
Atomic Energy Centre, Lahore (Pakistan).

Field 02—WATER CYCLE

Group 2J—Erosion and Sedimentation

M. H. Qureshi, S. D. Ghauri, N. A. Hussain, N. Khan, and M. Mustafa.
Available from the National Technical Information Service as A/CONF.49/P/113. \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/113, June 1971, 8 p. 7 fig, 8 ref.

Descriptors: *Radioactive tracer, *Tracking technique, *Movement, *Path of pollutant, Irradiation, Inspection, Streambeds, Stream erosion, Sedimentation, Sediment distribution, Sediment transport, Sediment control, Monsoons, Sands, Estuaries.
Identifiers: Scandium glass sand, Concentration, Monsoon effect.

Studies were undertaken to determine the movement of sand in the vicinity of the Karachi Harbour using radioactive tracer techniques. One kg of Scandium glass sand was irradiated in the reactor at PINSTECH to yield an activity of about 50 curies of Sc-46. The radioactive glass tracer was injected at a point 3 miles from the entrance to the harbour and 2 1/2 miles from Clifton foreshore. The tracer was then surveyed for its movement using water-tight scintillation detectors towed by a boat in pre-monsoon and post-monsoon seasons. The tracer studies indicate that there is a slight movement during the pre-monsoon period preferentially in the direction of east. During the monsoon period the movement is extensive and is toward north-east. Figures 1-7 give details of the movement of the radioactive tracer sand. (Houser-ORNL)
W72-03315

APPLICATION OF STABLE AND RADIOACTIVE ISOTOPES TO HYDROLOGY AND SEDIMENTOLOGY,
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires; and Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 07B.
W72-03319

BIOLOGICAL CYCLING OF ELEMENTS AND STABLE ISOTOPES IN MARINE ENVIRONMENTS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 05B.
W72-03345

RIVERS AND THEIR DEPOSITS,
Reading Univ. (England). Dept. of Geology.
J. R. L. Allen.
Sci Progr. 59 (233): 109-122. Illus. 1971.
Identifiers: Denudational, Depositional, Deposits, Rivers.

Rivers have been a major feature of the landscape for at least a substantial part of geological time, playing important denudational and depositional roles. As we know today, characteristic deposits are laid down by rivers, and these can best be understood through studies, quantitative whenever possible, of river processes. Sedimentary geologists have in this respect already learned much in recent years from workers in other disciplines. As the result, our understanding of river sediments has kept pace with our descriptive knowledge.--Copyright 1971, Biological Abstracts, Inc.
W72-03384

THE DETRITIC ORIGIN OF PROVENÇAL RIVERS IN A MARINE ENVIRONMENT,
Centre d'Océanographie, Marseille (France). Station Marine d'Endoume.
Herve Chamley, and Françoise Picard.
Tethys. 2 (1): 211-226. Map. 1970. English summary.
Identifiers: Detritic, Environment, France, Marine, Origin, Provençal, Rivers.

The study of clay and heavy minerals from the mouths of Provence rivers showed alluvial deposits from calcareous Provence, Maures, Esterel and Tanneron mountains, and from the region of Nice. The drained area is either crystalline or sedimentary.--Copyright 1971, Biological Abstracts, Inc.
W72-03387

SEDIMENT PROFILE CAMERA FOR IN SITU STUDY OF ORGANISM-SEDIMENT RELATIONS,
Yale Univ., New Haven. Dept. of Geology and Geophysics.
Donald C. Rhoads, and Steven Cande.
Limnol Oceanogr. 16 (1): 110-114. Illus. 1971.
Identifiers: Camera, Organism, Profile, Relations, Sediment.

An instrument is described that will take high resolution photographs of silt-clay bottom types in profile. The bottom (10-20 cm) is penetrated by a slowly descending (<7 cm/sec) wedge-shaped Plexiglas chamber, and the sediment profile that is cut is photographed. Such photographs reveal in situ details of bottom topography, sediment texture, depth of bioturbation, biogenic structures, and living positions of mud-dwelling benthos. The instrument can be modified to take closeup vertical photographs of the bottom and to obtain undisturbed core samples.--Copyright, 1971, Biological Abstracts, Inc.
W72-03496

2K. Chemical Processes

SOLUTE SEGREGATION IN ICE OBSERVED BY AUTORADIOGRAPHY,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 02C.
W72-02964

A GC METHOD FOR THE DETERMINATION OF NITROLITRACETIC ACID IN LAKE WATER,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.
For primary bibliographic entry see Field 05A.
W72-03051

HYDROLOGY AND SEDIMENTOLOGY OF THE CHATEAU RIVER (KERGUELEN ARCHIPELAGO),
For primary bibliographic entry see Field 02J.
W72-03052

HYDROGEOLOGY OF THE NORTHERN YENISEY REGION (GIDROGEOLOGIYA YENISEYSKOGO SEVERA),
Nauchno-Issledovatel'skii Institut Geologii Ark-tiki, Leningrad (USSR).
For primary bibliographic entry see Field 02F.
W72-03063

METAL ION CONTENT OF NIAGARA RIVER WATER,
State University Coll. Buffalo, N.Y. Dept. of Chemistry.
For primary bibliographic entry see Field 02H.
W72-03116

WATER MASS IDENTIFICATION IN A SMALL LAKE USING CONSERVED CHEMICAL CONSTITUENTS,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 02H.
W72-03117

INFLUENCE OF MINERALOGY AND MICROORGANISMS ON IRON AND SULFIDE CONCENTRATIONS IN GROUNDWATER,
Missouri Univ., Columbia. Dept. of Geology.
A. B. Carpenter, P. A. Goydan, G. C. Burton, and B. K. Leach.
Available from the National Technical Information Service as PB-205 773, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, Columbia, Sept 1, 1971, 36 p, 10 fig, 8 tab, 14 ref. OWRR A-033-MO (1).

Descriptors: Aqueous solutions, *Groundwater, *Anaerobic bacteria, *Analytical techniques, Nitrites, Nitrates, Microorganisms, *Oxidation-reduction potential, *Reduction (Chemical), Iron, Sulfides, *Electrochemistry.

Examination of a series of equilibrium diagrams indicates that the redox-species ratio method described by Thorstenson (1970) for the determination of the redox potentials of water samples is inherently limited to a small fraction of the full range of redox potentials which occur in natural waters. The subsurface water samples studied during this investigation are out of redox equilibrium with respect to dissolved nitrogen gas. The relationships between nitrate, nitrite, and ammonia in these samples are not consistent with any equilibrium or metastable equilibrium model which can be developed from current thermodynamic data. It is most likely that either the water samples are not in any kind of equilibrium configuration with respect to nitrite or that the free energy data for nitrite are in error. Many of the water samples show substantial disagreement between certain chemical relationships predicted from electrode redox potential measurements and the observed chemical relationships. Most of the groundwater samples contain one or more organisms capable of producing H₂S from this sulfate media. Groundwater samples containing obligate anaerobes all have lower electrode redox potentials than $p_e = 3$ at pH = 7. Much of the work initiated under this project is being continued under OWRR Project No. B-077-MO.
W72-03147

CHEMISTRY OF NATURAL WATERS -- V. HARDNESS,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
P. H. Kemp.
Water Research, Vol 5 No 10, p 933-941, October 1971. 1 fig, 4 tab, 4 ref.

Descriptors: *Hardness (Water), *Water chemistry, *Natural streams, *Calcium carbonate, Laboratory tests, Analytical techniques, Scaling, Mathematical studies, Chemical analysis.
Identifiers: Temporary hardness (Water), Permanent hardness (Water).

The definition and measurement of total and permanent hardness are discussed. A stoichiometric division of the total hardness into carbonic and noncarbonic components is also made. After consideration of the values of the relevant solubility products, it is shown that the noncarbonic hardness is approximately equal to the permanent hardness, apart from about 25 mg/liter of CaCO₃ which remains in solution after the deposition of the temporary hardness. Natural waters with TDS less than about 70 mg/liter therefore do not show temporary hardness. There is no invariable relationship between the temporary and permanent hardness of a water and its scale forming powers as measured by the pH. (Woodard-USGS)
W72-03169

SPECULAR REFLECTANCE OF AQUEOUS SOLUTIONS,
Missouri Univ., Kansas City. Dept. of Physics.
For primary bibliographic entry see Field 01B.
W72-03176

BINDING AND PRECIPITATION OF TRACE ELEMENTS BY HUMIC SUBSTANCES IN NATURAL WATERS.

Rhode Island Univ., Kingston. Water Resources Center.

J. McN. Sieburth.

Available from the National Technical Information Service as PB-205 777, \$3.00 in paper copy, \$0.95 in microfiche. Rhode Island Water Resources Center, Kingston, Completion Report (N.D.), 9 p, 3 ref. OWRR-A-034-RI (1).

Descriptors: *Trace elements, *Humus, *Estuaries, *Precipitation, *Sediment, *Microorganisms, *Metals, Iron, Copper, Atlantic Ocean, Southeast U.S.

Identifiers: Zinc, Lead.

Water samples from the southeastern coast of the U.S. were analyzed for free and bound iron, copper, zinc, and lead as well as pH, salinity, filterable material, humic material, dissolved organic carbon and color. A positive correlation between color and dissolved organic carbon and negative correlations with filterable material and salinity show the loss of humic materials in estuaries. Laboratory experiments with both synthetic and natural humic material suggests that trace metals may be removed along with the humic materials. The metal analyses from the water samples are consistent with this suggestion. (McNab-Rhode Island)

W72-03180

ELECTROPHORETIC AND ELECTROCHEMICAL WATER PURIFICATION SYSTEMS,

Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D.

W72-03182

INVESTIGATION OF THE USE OF CHLORIDE FROM PRECIPITATION AS A GROUND WATER TRACER,

Montana Univ., Bozeman. Joint Water Resources Research Center.

For primary bibliographic entry see Field 02F.

W72-03187

INVESTIGATION OF CALCIUM SULFATE PRECIPITATION,

Monsanto Research Corp., Everett, Mass.

For primary bibliographic entry see Field 03A.

W72-03195

STUDIES IN ELEMENT BALANCES IN A SMALL CATCHMENT AT TAITA, NEW ZEALAND,

Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.

G. G. C. Claridge.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 523-540, 1970. 4 fig, 6 tab, 19 ref.

Descriptors: *Sampling, *Water chemistry, Streamflow, Leaching, Weathering, Small watersheds, Aqueous solutions, Monitoring, Rainfall, Chlorides, Sodium, Calcium, Magnesium. Identifiers: Experimental watersheds.

Streamflow from a catchment of 11.6 acres was measured and integrated with a sampling device to collect samples from the stream after the passage of every 1,000 gallons. These samples were analyzed for Cl, Na, Ca, and Mg. Rainwater collections were made at five sites and analyzed for the same ions as the stream water samples. Variability between sites was found to be high. Over the period from 1/4/69 to 1/3/70, the input to the catchment in rainfall was calculated to be 28 lb Cl, 14 lb Na, 2 lb K, 2.3 lb Ca, and 2 lb Mg per acre. During the same period the output from the

catchment in the stream flow was calculated to be 26 lb Cl, 19 lb Na, 1.4 lb K, 1.9 lb Ca, and 1.3 lb Mg per acre. Within the limits of accuracy of the analysis of the incoming rainfall, the input and output may be considered to balance. (See also W72-03247) (Knapp-USGS) W72-03271

UNDERGROUND LEACHING OF URANIUM ORES,

Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.

A. P. Zefirov, B. V. Nevsky, V. G. Bakhturov, I. K. Lutsenko, and S. G. Vecherkin.

Available from the National Technical Information Service as A/CONF.49/P/459, \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/459, June 1971. 22 p, 5 fig, 1 tab, 9 ref.

Descriptors: *Uranium radioisotopes, *Mining, *Chemical reactions, *Separation techniques, *Leaching, *Solubility, *Sedimentary rocks, Sedimentary structures.

Identifiers: Ore processing, Tailings, Dissolution, Solution, Ore deposits, Solvent extraction.

In the USSR, the leaching of uranium ores in situ has developed into an independent chemical method of ore processing. The uranium is dissolved in situ by a chemical reagent. The product is delivered to the surface not as ore but as a uranium-bearing chemical solution. Two flowsheets have been developed: one for the recovery of uranium from solid (massive) rocks and the other for beaded sedimentary ore deposits. Each flowsheet is discussed. (Houser-ORNL) W72-03326

2L. Estuaries**TIDAL HYDRODYNAMIC SIMULATION IN SHALLOW ESTUARIES,**

Texas Univ., Austin. Hydraulic Engineering Lab.

F. D. Masch, and R. J. Brandes.

Available from the National Technical Information Service as PB-205 590, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report HYD 12-7102, August, 1971, 102 p, 23 fig, 9 ref. OWRR C-1158 (No 1591) (2) Pt. 1.

Descriptors: *Estuaries, *Tides, *Bays, *Model studies, *Tides, *Dispersion, Texas, Computer programs, Convection.

Identifiers: *Convective-dispersion processes, *Transport models, *Tidal hydraulics, Short-term variations, Concentration distributions, Shallow bays, Matagorda Bay, Galveston Bay, Clear Lake (Tex).

A numerical model for computing time histories of tidal amplitudes and vertically integrated velocities in two coordinate (area-wise) directions is described. The model accounts for irregular bathymetry, bottom roughness, spoil banks, reefs and islands and for variable inflows, tidal action and other hydrologic features typical of Gulf Coast embayments. From the basic model responses, it is possible to compute phase relations, times of flood, ebb and slack tide, tidal prisms, exchange, net flows, and to obtain plots of particle paths and velocity vector diagrams at any phase of the tide. The model is designed to be responsive to the input demands of transport models. Specifically, the basic output is used directly in the convective components of transport processes within consecutive tidal cycles. Net flows obtained from integration of the temporal velocity and depth variations are used for convective input to those transport processes involving slowly varying hydrologic inputs. (See also W72-03054 and W72-03055) W72-03053

A SLOWLY-VARYING CONSERVATIVE TRANSPORT MODEL FOR SHALLOW ESTUARIES,

Texas Univ., Austin. Hydraulic Engineering Lab.

R. J. Brandes, and F. D. Masch.

Available from the National Technical Information Service as PB-205 591, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report HYD 12-7103, August 1971, 171 p, 39 fig, 2 append. OWRR C-1158 (No 1591) (2) Pt. 2.

Identifiers: *Convective-dispersion processes, *Transport processes, *Transport models, *Guadalupe estuary, *Tidal hydraulics, Slowly varying concentration distributions, Shallow estuaries, Gulf Coast, *Lavaca-Tres Palacios estuary.

The development and application of a two-dimensional long-term dynamic numerical transport model which is capable of describing the spatial and temporal slowly-varying distributions of conservative constituents in shallow, well-mixed estuaries is presented. The model provides a basis for economically and practically analyzing the overall environmental effects of water resource development and estuarine management programs on the natural state of coastal waters. The concept of using net velocities determined over a tidal cycle for convective inputs to the transport model reduces the required solution time for a particular problem, yet still provides temporal resolution consistent with that necessary for long-term analyses. The solution method used in the model is an alternating direction implicit numerical scheme applied to central difference approximations of the derivatives in the basic two-dimensional convective-dispersion mass-balance equation. The transport model is applied to two prototype systems on the Texas Gulf Coast; the principal bay waters of the Guadalupe and the Lavaca-Tres Palacios estuaries. Through these applications involving distributions of salinity, the response of the model to different initial conditions, time steps, fresh water inflows, and dispersion coefficients is tested, and the simulation capability of the model is established with comparisons between corresponding computed and measured salinity concentrations. Documentation of the model is presented together with program listings, variable definitions, flow charts, data input formats, and sample output. (See also W72-03053 and W72-03055) W72-03054

A SHORT-TERM CONSERVATIVE TRANSPORT MODEL FOR SHALLOW ESTUARIES,

Texas Univ., Austin. Hydraulic Engineering Lab.

F. D. Masch, M. Naryanan, and R. J. Brandes.

Available from the National Technical Information Service as PB-205 592, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report HYD 12-7104, August 1971, 90 p, 36 fig, 25 ref, 2 append. OWRR C-1158 (No 1591) (2) Pt. 3.

Descriptors: *Estuaries, *Tides, *Bays, *Model studies, *Tides, *Dispersion, Texas, Computer programs, Convection.

Identifiers: *Convective-dispersion processes, *Transport models, *Tidal hydraulics, Short-term variations, Concentration distributions, Shallow bays, Matagorda Bay, Galveston Bay, Clear Lake (Tex).

A two-dimensional convective-dispersion transport model is described which provides spatial and temporal variations in the concentration of a conservative constituent introduced into a shallow well-mixed estuary. The solution is accomplished through a multi-stage implicit method and the model utilizes as basic input instantaneous tidal velocities, depths and dispersion coefficients computed from an operational mathematical tidal hydrodynamics model. The transport model is capable of accepting slug, continuous or intermittent releases at one or more points within the tidal flow system. The application of the model is demonstrated by slug and continuous releases of conservative materials into high and low tidal

Field 02—WATER CYCLE

Group 2L—Estuaries

velocity areas in Matagorda Bay, Texas. The model is operated to generate results which are compared with measurements from dye release studies made in a physical model of Galveston Bay. Application of the transport model to a fine grid representation of a localized area is also demonstrated for the Clear Lake area in Galveston Bay. Utilizing the Matagorda Bay example the sensitivity of the model to different magnitudes of the dispersion coefficient is studied for a range of coefficients from 0 to 500/sq ft/min. Documentation of the model program is presented together with notations, flow chart and listings. (See also W72-03053 and W72-03054)
W72-03055

PROCESSES AND HISTORY OF TERMINOS LAGOON, MEXICO,
Scripps Institution of Oceanography, San Diego, Calif.
For primary bibliographic entry see Field 02H.
W72-03069

COASTAL ENGINEERING - 1970 PROCEEDINGS.
For primary bibliographic entry see Field 08B.
W72-03078

WAVE INVESTIGATIONS IN SHALLOW WATER,
Forschungsgruppe Neuwerk, Cuxhaven (West Germany).
For primary bibliographic entry see Field 08B.
W72-03087

TURBIDITIES OF THE HATTERAS AND SOHM ABYSSAL PLAINS, WESTERN NORTH ATLANTIC,
Lamont-Doherty Geological Observatory, Palisades, N. Y.
For primary bibliographic entry see Field 02J.
W72-03156

UNDERWATER TIME-LAPSE MOTION PICTURE SYSTEMS,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W72-03157

TECHNIQUES AND EQUIPMENT REQUIRED FOR PRECISE STREAM GAGING IN TIDE-AFFECTED FRESH-WATER REACHES OF THE SACRAMENTO RIVER, CALIFORNIA,
Geological Survey, Washington, D.C.
W. Smith.
Available from GPO, Washington, D.C. 20402 - 75 cents (paper cover). Geological Survey Water-Supply Paper 1869-G, 1971. 46 p, 18 fig, 1 plate, 5 tab, 10 ref.

Descriptors: *Streamflow, *Flow measurement, *Estuaries, *California, Analytical techniques, Tidal waters, Tidal effects, Stream gages, Data collections, Hydrologic data, Computer programs, Systems analysis, Input-output analysis, Equipment, On-site tests.
Identifiers: *Sacramento River (Calif).

Analysis of a large quantity of data on the velocity distribution in the tidal channel of the Sacramento River at Chippis Island, California shows that adequate definition of the velocity can be made during the dominant flow periods—that is, at times other than slack-water periods—by use of current meters suspended at elevations 0.2 and 0.8 of the depth below the water surface. In the proposed system all gaged parameters, including velocities, depths, position in the stream, and related times, are monitored continuously as a boat moves across the river on the selected cross section. Data are recorded photographically and transferred onto punchcards for computer processing. Com-

puter programs were written to permit computation of instantaneous discharges at any selected time interval throughout the period of the current-meter measurement program. Current-meter traverses will be made at intervals of about one-half hour over periods of several days. Capability of performance for protracted periods was, consequently, one of the important elements in system design. Analysis of error sources indicates that errors in individual computed discharges can be kept smaller than 1.5% if the expected precision in all measured parameters is maintained. (Woodard-USGS)
W72-03164

BINDING AND PRECIPITATION OF TRACE ELEMENTS BY HUMIC SUBSTANCES IN NATURAL WATERS,
Rhode Island Univ., Kingston. Water Resources Center.
For primary bibliographic entry see Field 02K.
W72-03180

PHYTOPLANKTON PRIMARY PRODUCTION IN SOME FINNISH COASTAL AREAS IN RELATION TO POLLUTION,
Institute of Marine Research, Helsinki (Finland); and Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 05C.
W72-03228

AN INSTRUMENT FOR MEASURING THE ELECTRICAL CONDUCTIVITY OF SEA WATER FROM SHIPBOARD,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 07B.
W72-03245

STRUCTURE AND FORMATION OF COASTAL BOTTOM PLACERS IN THE EASTERN BALTIC,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W72-03246

SEDIMENT STUDY AT KARACHI BY MEANS OF RADIOACTIVE TRACERS,
Atomic Energy Centre, Lahore (Pakistan).
For primary bibliographic entry see Field 02J.
W72-03315

SOME APPLICATIONS OF RADIOISOTOPES IN COASTAL POLLUTION CONTROL,
Danish Isotope Center, Copenhagen.
For primary bibliographic entry see Field 05B.
W72-03340

BIOLOGICAL CYCLING OF ELEMENTS AND STABLE ISOTOPES IN MARINE ENVIRONMENTS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 05B.
W72-03345

THE DETRITIC ORIGIN OF PROVENCAL RIVERS IN A MARINE ENVIRONMENT,
Centre d'Océanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 02J.
W72-03387

VAUCHERIA SPECIES AND SOME OTHER ALGAE ON A DUTCH SALT MARSH, WITH ECOLOGICAL NOTES ON THEIR PERIODICITY,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
P. H. Nienhuis, and J. Simons.
Acta Bot Neerl. 20 (1): 107-118. Illus. 1971.

Identifiers: Algae, Dutch, Ecological, Frost, Marsh, Moisture, Periodicity, Salinity, Salt, Soil, Species, Vaucheria, Vaucheria-Arcassonensis, Vaucheria-Compacta, Vaucheria-Coronata, Vaucheria-Intermedia, Vaucheria-Minuta, Vaucheria-Sphaerospora, Vaucheria-Thuretii, Vaucheria-Vipera.

A survey of the distribution and the periodicity of 8 *Vaucheria* species (*V. arcassonensis*, *V. compacta*, *V. coronata*, *V. intermedia*, *V. minuta*, *V. sphaerospora*, *V. thuretii* and *V. vipera*) on the Dutch salt marsh Springersgras in relation to environment and vegetation pattern of algae and higher plants is given. The quantitative changes occurring in the algal vegetation (green algae, blue-green algae and *Vaucheria* spp.) on 2 permanent quadrats, checked monthly algae and higher plants if given over a period of 2 yr, are given in relation to some important ecological factors. Both sample plots, situated at MHWS (mean high water spring tide) level on the tidal marsh, constitute an unstable habitat with large changes in soil moisture content (42-165 g H₂O/100 g soil) and in salinity of the soil moisture (0.8-72.4‰ Cl⁻). The periodicity of 5 *Vaucheria* spp. could be correlated with the action of extreme environmental conditions (desiccation, high salinities, frost).—Copyright 1971, Biological Abstracts, Inc.
W72-03391

ECOLOGY OF THE PLANT POPULATIONS OF THE RICHARD'S BAY AREA,
H. J. T. Venter.
S Afr J Sci. 67 (2): 52-55. 1971 English summary.
Identifiers: Africa, Bay, Ecology, Halosere, Hydrosere, Plant, Populations, Psammose.

Composition and character of the plant communities of the psammose, halosere and hydrosere are outlined. The influence of environment, vegetation development and future of Richard's Bay are briefly discussed.—Copyright 1971, Biological Abstracts, Inc.
W72-03394

HYDROLOGY AND SALINITY OF BALTIC SEA-SHORE MEADOWS: STUDIES IN THE ECOLOGY OF BALTIC SEA-SHORE MEADOWS III,
Lund Univ. (Sweden). Dept. of Plant Ecology.
Germund Tyler.
Oikos. 22 (1): 1-20. Illus. Map. 1971 Russian summary.
Identifiers: Baltic, Drainage, Ecology, Hydrology, Meadows, Salinity, Sea, Seasonality, Shore, Sweden, Zonation.

The hydrology and salinity properties in an area about 60-150 km south of Stockholm have been related to the main plant communities described in previous papers. Fluctuations in the water level of the sea and the water level of open pits were recorded and the measurements compared with the zonal differentiation of the plant cover. The seasonal variation in the salinity of the rhizosphere is illustrated and discussed. It is concluded that high salinity exerts a powerful selection and only a few species will be able to survive. Within the vegetation complex, however, drainage conditions chiefly decide the vertical range of the enduring species and the zonal differentiation of the plant cover.—Copyright 1971, Biological Abstracts, Inc.
W72-03396

STUDIES OF ESTUARINE DEPENDENCE OF ATLANTIC COASTAL FISHES,
Sandy Hook Marine Lab., Highlands, N.J.
John Clark, W. C. Smith, Arthur W. Kendall, Jr., and Michael P. Fahay.
U S Bur Sport Fish Wildl Tech Pap. 28: 3-132. Illus. Map. 1969.
Identifiers: Atlantic, Coastal, Dependence, Estuarine, Fishes, Plankton, Temperature, Zoo.

The basic data is presented from a 1st series of surveys, the northern section, which includes 8

cruises of the research vessel Dolphin from Cape Cod, Massachusetts, to Cape Lookout, North Carolina, Dec. 1965 to Dec. 1966. The data include temperatures, salinities, zooplankton volumes, and the mid-water trawl collections of fishes.—Copyright 1971, Biological Abstracts, Inc. W72-03500

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

TRANSPORT PROCESSES IN ELECTROCHEMICALLY CONTROLLED ION-EXCHANGE DESALINATION, Rocketdyne, Canoga Park, Calif. S. Evans, M. A. Accomazzo, J. E. Accomazzo, M. Lodacki, and K. E. Lossett.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$1.25. Office of Saline Water Research and Development Progress Report No. 409, March 1969, 86 p, 31 tab, 12 fig, 15 ref. 14-01-0001-1316.

Descriptors: *Desalination processes, *Electrodes, *Ion exchange, *Electrochemistry, Resins, *Anion exchange, *Cation exchange, Ion transport, Kinetics, Model studies.
Identifiers: *Kraton binder.

The chemically determined ion-exchange kinetics of ion-exchange composites were used to develop a model to represent the transport processes associated with the electrochemically controlled ion-exchange process. Electrochemical experiments were carried out to test the applicability of this model and to obtain information as to the limiting currents that could be associated with this process. New binder systems were investigated for electrode fabrication. (OSW abstract) W72-02976

STATE OF WATER IN OSMOTIC PROCESSES, Scripps Institution of Oceanography, San Diego, Calif.

For primary bibliographic entry see Field 01B. W72-03023

ELECTROCHEMICALLY CONTROLLED ION-EXCHANGE, North American Rockwell Corp., Canoga Park, Calif.

Sheldon Evans, Mauro A. Accomazzo, Michael Ladacki, and Kenneth A. Lossett.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$0.70. Office of Saline Water Research and Development Progress Report No. 598, December 1970, 71 p, 14 fig, 28 tab, 7 ref. OSW Contract No. 14-01-0001-1316.

Descriptors: *Desalination processes, *Electrodes, *Ion exchange, *Desalination processes, *Ion exchange, Membranes, Electrochemistry, Ion transport, Anion exchange, Cation exchange.

The chemically determined ion-exchange kinetics at anion and cation-responsive electrodes were used to refine a previously developed model to represent the transport processes associated with electrochemically controlled ion-exchange. New binder systems were investigated for electrode fabrication. Electrochemical experiments were carried out to obtain information as to the limiting currents that could be associated with this process, to evaluate new combinations of binder systems, ion-exchange resins, and carbons, and to determine the suitability of electrodes to ions other than sodium and chloride. (OSW Abstract) W72-03131

NEW SELECTIVE MEMBRANES, Polytechnic Inst. of Brooklyn, N. Y. J. Steigman, and B. Luftig.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$1.00. Office of Saline Water Research and Development Progress Report No. 704, July 1971, 83 p, 46 tab, 25 fig, 37 ref. OSW Grant No. 14-01-0001-1645.

Descriptors: *Desalination processes, *Membrane processes, *Cellulose, Anion adsorption, Cation adsorption, Ions, *Sodium, *Calcium, Reverse osmosis.

Regenerated cellulose films treated in alkaline aqueous solutions of 1-cyclohexyl-3-(2-morpholinoethyl)-carbodiimide retard the passage of dilute calcium salt solutions compared to sodium. Infrared spectra showed that a substituted urea had been formed in the film, presumably with a quaternary ammonium group attached. This was indirectly confirmed by the marked increase in adsorption of anionic Phenol Red, and a marked decrease in adsorption of cationic Methylene Blue. The effects of varying reagent concentration and other variables were examined. Films treated in a 67% carbodiimide solution showed an average salt rejection value of 97.4% for 0.01M calcium over the range 250-1,000 p.s.i. Treatment of cellulose with the reagent in succinic acid solution produced films whose infrared spectra showed carboxylic acid groups; these films strongly adsorbed calcium ions, and strongly adsorbed cationic Methylene Blue. The self-diffusion coefficient of water in cellophane at 25 was found to be unaffected by treatment either in acid or alkaline solution. The apparent self-diffusion coefficients, the partition coefficients and the intrinsic self-diffusion coefficients of calcium and sodium in untreated, alkaline-treated and succinic acid-treated films were determined at 25 over the concentration range .00001 to 1M. The results were explained on the basis of electrostatic effects. (OSW Abstract) W72-03132

STUDY OF BIOLOGICAL DESALINATION PHENOMENA: SALT TRANSPORT MECHANISMS OF SELECTIVE AVIAN SALT GLANDS, Atlantic Research Corp., Alexandria, Va.

E. Usdin, J. M. Spurlock, and J. A. Simmons.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$0.75. Office of Saline Water Research and Development Progress Report No. 433, June 1969, 80 p, 5 fig, 5 tab, 234 ref. Grant 14-01-0001-1674.

Descriptors: *Membranes, *Desalination, *Biological membranes, *Saline water, Permeable membranes, Ion transport, Semipermeable membranes, Separation techniques.
Identifiers: *Avian salt glands, Biological desalination, Mosaic membranes.

Salient mechanistic and structural characteristics of selective ion transport by avian salt glands were investigated with the overall objective of identifying the mechanisms involved which may have application for the development of new or improved desalination processes. An exhaustive literature study has been completed on the avian salt gland and is included in this report. In preparation for future work, a thorough survey has also been made of tissue electrical stimulation studies. In the study of the salt gland of the White China goose, some difficulty was experienced in acclimating the geese to high salt concentrations in their diets, but this difficulty was overcome by temporarily replacing the salt water with fresh water for short periods. The glands have been shown to have an active NaO - KO ATPase system as shown by inhibition of the enzymatic hydrolysis on the addition of ouabain. Attempts were made to show uptake of ²²NaO. The salt glands of White China geese have been studied both in vivo and in vitro. Systems for separating inorganic ²²Na from ²²Na attached to

an organic moiety have been devised and attempts were made to identify the organic moiety. In the in vitro experiments, there has been minimum incorporation of ²²Na into gland slices, even when NaO - KO ATPase has been shown to be quite active, leading to the tentative conclusion that this mechanism is not adequate to explain active transport in the avian salt gland. (OSW abstract) W72-03133

ELECTRICAL PROPERTIES OF ELECTRODIALYSIS MEMBRANES, California Univ., Berkeley.

R. A. Wallace.
Office of Saline Water Research and Development Progress Report No. 407, n.d., 42 p, 6 fig, 23 tab, 16 ref. Grant No. 14-01-0001-1089.

Descriptors: *Electrodialysis, *Permeable membranes, *Ion transport, Conductivity, Membrane processes, Mass transfer.
Identifiers: *Membrane properties, Anion membranes, Cation membranes, Mobility, Membrane polarization, Dielectric properties.

Electrical conductivities of leached cation- and anion-permeable electrodialysis membranes in a number of monovalent ionic forms were determined under precisely controlled conditions of temperature, membrane water content, and d.c. voltage gradient. A new semitheoretical mobility equation was developed and experimentally verified for the passage of ions in common electrodialysis membranes. All conductivity measurements were carried out in the absence of external electrolyte or leached membrane state. Calculated mobilities of hydrogen, sodium, and potassium ions in typical cationic electrodialysis membranes are presented as a function of the entire membrane water content range at room temperature. In addition, the calculated mobilities of hydroxyl and chloride ions in typical anionic electrodialysis membranes are also given over the total membrane water-content range at room temperature. The dielectric properties of sulfonate cation-permeable membranes in their hydrogen, sodium, and potassium forms were studied over the frequency range of 100 - 100,000 cps, with water content and temperature as parameters. Membrane dielectric constant and loss characteristics are interpreted in terms of specific polarization and by Cole-Cole plots. Dielectric dispersions were observed for wet sulfonate membranes and are judged to be water-induced. At low membrane water content, two distinct membrane hydration stages were noted. In addition, dielectric dispersion processes and their activation energies were computed for the wet membrane in hydrogen, sodium, and potassium forms. (OSW abstract) W72-03134

OPERATION OF REVERSE OSMOSIS PILOT PLANTS, Aerojet-General Corp., El Monte, Calif.

C. G. DeHaven, and E. R. Watson.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$1.50. Office of Saline Water Research and Development Progress Report No. 422, May 1969, 146 p, 15 tab, 50 fig, 2 ref. Grant No. 14-01-0001-945.

Descriptors: *Reverse osmosis, *Cellulose, Membranes, Brackish water, Desalination plants, Pilot plants, Sea water, Testing.
Identifiers: Cellulose acetate, Plate-and-frame reverse osmosis.

The field testing is covered of 1000-gpd plate-and-frame pilot plants on sea and brackish waters as a concluding phase of several years work to develop the plate-and-frame concept for reverse osmosis for applications to both sea and brackish waters. Cellulose acetate membranes were developed under separate programs. The pilot plant design was based on an 18 in. diameter circular, slotted plate composed of phenolically bounded fiber

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

glass with membranes sealed to either side. The units contained 100 sq ft of membrane area. Brackish water pilot plants were operated respectively at Laguna Beach (2) and Perris, California. A sea water pilot plant was tested at Newport Beach. In the brackish water tests, special attention was given to the use of Cyanamer P-35 as an anti-foulant. The use of citric acid for iron removal was investigated. The Perris well contained Boron for which only limited removal was achieved. The tests on brackish water were comparatively successful, however, tests on sea water were characterized by successful initial operation (1500 psi) with rapid deterioration of the flux and salt rejection. (OSW abstract)
W72-03135

DESIGN AND FABRICATION OF A 50,000 GPD PORTABLE REVERSE OSMOSIS PILOT PLANT

Aerojet General Corp., El Monte, Calif.
E. R. Watson.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$2.00. Office of Saline Water Research and Development Progress Report No. 431, May 1969, 58 p, 26 fig. Grant No. 14-01-0001-930.

Descriptors: *Reverse osmosis, *Cellulose, *Brackish water, *Sea water, *Desalination, Costs, Pilot plants, Design.
Identifiers: Cellulose acetate.

The design and construction are discussed of a 50,000-gpd brackish-water reverse-osmosis pilot plant based on the plate-and-frame concept. This project evolved from several years previous work at Aerojet on the plate-and-frame design and the production of the cellulose acetate membranes for this purpose. (See OSW R and D Progress Reports Nos. 213, 356, 427, 429, 430). The design and construction features of the unit are described. Photographs of the plant and detailed drawings of all elements are presented. Main features of the design are the use of a single cylindrical pressure vessel which contains circular membrane support plates 36 inches in diameter. Total membrane area is 2750 square feet. The entire unit is mounted on a 40-ft. highway trailer. A projected cost estimate is included. (See also W70-01396 and W70-02050)
W72-03136

PROCESS AND CONFIGURATION DEVELOPMENT FOR TUBULAR REVERSE OSMOSIS UNITS

Aerojet-General Corp., El Monte, Calif.
G. A. Fluke.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$2.75. Office of Saline Water Research and Development Progress Report No. 426, May 1969, 195 p, 5 tab, 41 fig. Grant No. 14-01-0001-1764.

Descriptors: *Reverse osmosis, *Cellulose, *Membranes, *Brackish water, Desalination plants, Pilot plants, Tubes.
Identifiers: Cellulose acetate, Glass fiber.

This is an overall study covering the development of a tubular reverse osmosis system whose special feature is the use of a braided fiber glass support tube and interior cellulose acetate membrane all of which is formed in a single integrated operation. In effect, tube braiding and cellulose acetate membrane casting are performed in one machine at the same time. Details of the braiding and membrane casting are discussed. A 1000-gpd pilot plant was designed and constructed. Detailed drawings are provided of the header systems, tube fittings into the header and the pilot plant itself. Certain parametric studies were made to support the unit design and establish a 1/2 inch tube diameter. (OSW abstract)
W72-03137

DEVELOPMENT OF METHODS FOR DETERMINING ICE PARTICLE SIZE DISTRIBUTION FROM FREEZE DESALINATION CRYSTALLIZERS

North American Rockwell Corporation, Canoga Park, California, Rocketdyne Division.
G. R. Schneider, P. R. Newton, and D. F. Sheehan.
Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price \$0.50. Office of Saline Water Research and Development Progress Report No. 408, March 1969, 44 p, 5 tab, 17 fig, 2 ref. OSW Contract 14-01-0001-333.

Descriptors: *Desalination, *Freezing, *Ice, Desalination apparatus, *Particle size, Light, Crystals, Analytical techniques.
Identifiers: Crystallizer.

Two particle size analyzers, a forward light-scattering apparatus and a birefringent particle size analyzer were investigated for determining the ice particle size distribution from freeze desalination crystallizers. The forward light-scattering apparatus required a degasser in the ice-brine sample line to remove gas bubbles which also scatter light. The birefringent particle size analyzer, conceived, designed, and built for this program, only detects the birefringent ice crystals and requires no auxiliaries. Methods of calibrating both instruments for ice using ice-brine and other particle-liquid combinations having similar optical properties were explored. The results from these devices were compared with results on the ice particle size distribution found using a photographic technique. At this time both devices appear to be capable of accomplishing the task. A photographic technique was employed to obtain data on the effect of moderate variations in delta T (temperature difference between the refrigerant boiling point and the freezing point), residence time, salinity, and refrigerant flowrate upon the ice particle size distribution from a batch crystallizer. The effect of these variables on the size distribution was generally as expected. (OSW abstract)
W72-03192

TECHNICAL COOPERATION ON THE SOLAR DISTILLATION DEVELOPMENT PROGRAM OF SPAIN

O. G. Lof.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - Price \$0.50. Office of Saline Water Research and Development Progress Report No. 397, September 1968, 25 p, 2 tab, 12 fig, 10 ref. OSW Contracts 14-01-0001-697 and 14-01-0001-633.

Descriptors: *Solar stills, Solar distillation, Desalination apparatus, Desalination plant, Cost analysis, Design.
Identifiers: Las Marinas (Spain).

Described are the design, construction and operation of a 9500 sq. ft. solar distillation plant at Las Marinas, Spain. The project was a cooperative undertaking between several departments of the Spanish Government and the Organization for Economic Cooperation and Development (OECD). The consultant, under two OSW contracts, was to provide advice and information to the interested organizations and review and discuss basic designs. A visit to the plant site was made when the still was near completion and during the following 12 months when it was operational. The final results of the first year of operation are analyzed and interpreted in light of developments in the USA and elsewhere. A description and analysis are presented of the essential features of the Spanish solar distillation project. Included are cost data and other designs, such as the use of heat supply from a 100-kw generator to augment solar distillation.
W72-03193

FOAM FRACTIONATION OF AQUEOUS SOLUTIONS

Horizons Research, Inc., Cleveland, Ohio.
J. J. Bikerman.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - Price \$0.65. Office of Saline Water Research and Development Progress Report No. 382, January 1969, 52 p, 10 tab, 5 fig. OSW Contract 14-01-0001-1265.

Descriptors: *Demineralization, *Desalination, *Foam fractionation, *Iron, *Manganese, *Gels, *Reverse osmosis, Electrodialysis, *Membrane processes, *Detergents, Foaming.
Identifiers: *Ion flotation, Iron hydroxides, *Manganese hydroxides.

The presence of iron and manganese ions gives rise to many technical difficulties during the desalination of brackish waters because of the formation of iron and manganese hydroxide gels. These gels form on the surfaces of electrodialysis and reverse osmosis membranes and as a consequence reduce the operating efficiency of both processes. The development of technology for the selected removal of iron and manganese ions from brackish waters prior to desalination was attempted in these studies via the use of foam fractionation. The studies demonstrated that manganese and iron can be removed from brackish waters by foaming. Additional studies are recommended involving the removal of other interfering ions such as calcium and manganese. (OSW abstract)
W72-03194

INVESTIGATION OF CALCIUM SULFATE PRECIPITATION

Monsanto Research Corp., Everett, Mass.

M. Fabuss, and C. H. Lu.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - Price \$0.50. Office of Saline Water Research and Development Progress Report No. 258, May 1967, 100 p, 20 tab, 39 fig, 29 ref. OSW Contract 14-01-0001-465.

Descriptors: *Calcium sulfate, *Solubility, *Chemical precipitation, Crystallization, *Sea water, Distillation, Gypsum, Anhydrite, Calcium compounds, Scaling, Desalination, Heat transfer.

The precipitation of calcium sulfate from distilled water and from carbonate-free synthetic sea water concentrates was investigated by conducting two types of experiments, namely, heating at constant volume, and constant temperature evaporation. The constant volume heating experiments with distilled water covered a concentration range of 400 - 2000 ppm and an equilibrium temperature range of 90 - 155 deg C. The constant temperature evaporation experiments covered a temperature range of 80 - 180 deg C, initial concentrations of 100 - 1020 ppm, and an evaporation ratio of 2.3 to 4.1. In the 100 - 180 deg C temperature range, the precipitation of calcium sulfate from distilled water was controlled by the solubility curve of anhydrite. However, the precipitation with respect to anhydrite was a slow process; substantial precipitation occurred only when the solubility curve of hemihydrate was approached. The constant volume heating experiments with carbonate-free synthetic sea water concentrates covered a concentration factor range of 0.75 - 3.00 and a temperature range of 71 - 184 deg C. The constant temperature evaporation experiments covered a temperature range of 60 - 150 deg C with initial concentration factors of 0.30 to 1.75. The solutions were concentrated to about three times their original strengths. The mode of heat transfer (boiling or non-boiling) greatly affected the precipitation of calcium sulfate. The initial precipitation curve by evaporation lies practically on the calculated solubility limit of anhydrite, while the initial precipitation curve by heating lies between the calculated solubility limits of anhydrite and hemihydrate. (OSW abstract)
W72-03195

PROSPECTS OF A DUAL-PURPOSE NUCLEAR PLANT FOR MEETING WATER AND POWER REQUIREMENTS OF THE GREATER KARACHI AREA,
Pakistan Atomic Energy Commission, Karachi.
Ismat Kamal.

Available from the National Technical Information Service as A/CONF.49/P/299. \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/299, June 1971. 16 p.

Descriptors: *Nuclear powerplants, *Desalination plants, *Nuclear reactors, *Water supply, Water sources, Water quality, Water yield, Water purification, Water utilization, Water demand, Administration, Economics, Irrigation, Electric powerplants, Electric power demand, Economics.
Identifiers: Industrial usage, Domestic usage, Beneficial use-agriculture, Restricted usage, Requirements, Pakistan.

In view of the limitations of natural energy resources, the PAEC has initiated a modest program of nuclear power generation in Pakistan. Conditions in the Karachi area, experiencing rapid industrialization and situated far from the hydroelectric plants in the north, are particularly favorable for the development of nuclear power. At the same time a serious water shortage is anticipated in Karachi from 1980 onwards, as the allocation of additional water from the Indus River at the cost of irrigation requirements appears highly improbable. In view of these circumstances, the PAEC is studying the feasibility of a dual-purpose nuclear power-cum-desalination plant for the Karachi area. As preliminary indications appear favorable for the establishment of such a plant, the PAEC proposes to undertake more detailed studies on the water and power demand, alternative conventional sources of supply (with reference to their availability and cost economics), integrations of the products into the existing distribution systems, and other technical and economical aspects of the dual-purpose plant. (Houser-ORNL)

W72-03310

SUBSURFACE AND TRICKLE IRRIGATION; A SURVEY OF POTENTIALS AND PROBLEMS,
Oak Ridge National Lab., Tenn. Desalination Information Center.

For primary bibliographic entry see Field 03F.

W72-03314

A DISTILLATION CYCLE AND THE COMBINATION OF PROCESSES WHICH ARE APPLICABLE TO LARGE-CAPACITY DESALINATION PLANTS,

Centre d'Etude de l'Energie Nucleaire, Grenoble (France).

P. Balligand, J. Huyghe, F. Lauro, and P. Vignet.
Available from the National Technical Information Service as A/CONF.49/P/590. \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/590, June 1971. 14 p, 3 fig, 12 ref.

Descriptors: *Nuclear powerplants, *Desalination plants, *Desalination processes, *Separation techniques, *Vapor compression distillation, Sea water, Saline water, Electric powerplants, Water yield, Water yield improvement, Water conservation, Irrigation programs, Domestic water, Beneficial use, Industrial water, Evaluation, Feasibility.
Identifiers: Pretreatment, Heat-exchange, Corrosion, Scaling, Processes.

A unit for distilling 25,000 cu m of fresh water per day from sea water is described. The unit can be assembled into a facility with a capacity of several hundred thousand cu m per day by using many of these units in parallel and in association with a dual-purpose nuclear power station to produce both water and electricity. The interest is in fact with a large-capacity water plant using the exhaust steam from a back-pressure turbine and fractionating the production of water in a way to ensure the maximum flexibility and reliability for the plant. The description of the distillation plant conforms to an actual process, which could be quickly put to

use and for which the fundamental data have come from a large continuing experimental program. There remain a few advances still to be made with regard to this process. The research program that will give rise to these improvements is briefly described. The program is mainly concerned with the prevention of saline deposit, improvement of heat transfer, and the search for cheap materials resistant to salt-water corrosion. (Houser-ORNL)

W72-03322

ROVI: DEVELOPMENT PROJECT FOR INTERMEDIATE CAPACITY DESALTING PLANT DRIVEN BY AN ORGANIC COOLED AND MODERATED REACTOR,
Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

C. C. Bertoni, R. Di Menza, L. Biond, E. Crispino, and P. N. Della Mora.

Available from the National Technical Information Service as A/CONF.49/P/177. \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/177, May 1971. 15 p, 4 fig, 4 tab, 2 ref.

Descriptors: *Nuclear powerplants, Desalination plants, *Nuclear reactor, Water quality, *Water yield, Water sources, Water purification, Water demand, Sea water.

Identifiers: Organic coolant, Organic moderated reactor experiment, Organic cooled reactor, Heavy water organic cooled reactor, Italy.

The Italian National Committee for Nuclear Energy, CNEN, made a feasibility study on small and medium sized reactors to be utilized only for the production of the low temperature steam needed to drive a sea water distillation plant. The various types of reactors existing and generally utilized for the production of electrical energy were examined. With the organic cooled and moderated ones more definite and substantial advantages and savings, based on simplification of design and use of conventional materials and technologies, could be obtained going to the low temperature operation and to the medium sized installations required for this particular application. As a consequence the study was centered on the said type of reactors and the project called ROVI, literally organic reactor for industrial vapor. The results are reported. (Houser-ORNL)

W72-03325

THE ALGO-AGRO-INDUSTRIAL COMPLEX. AN AGRO-INDUSTRIAL COMPLEX AT NUCLEAR ENERGY CENTERS WITH ASSOCIATED PRODUCTION OF AUTOTROPHIC MICROORGANISMS,

Ceskoslovenska Akademie Ved, Prague. Inst. of Microbiology; and Ceskoslovenska Akademie Ved, Trebon. Lab. of Algology.

I. Malek, J. Bartos, J. Simmer, and B. Prokes.
Available from the National Technical Information Service as A/CONF.49/P/552. \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/552, May 1971. 20 p, 7 fig, 2 tab, 10 ref.

Descriptors: *Nuclear powerplants, *Desalination plants, *Electric power production, *Irrigation programs, *Agriculture, *Economics, Cyanophyta, Algae, Plants, Proteins, Nutrients, Biomass, Harvesting of algae, Productivity.
Identifiers: Agro-industrial complex, Electric energy consumption, Model testing.

This paper considers the production of the biomass of autotrophic microorganisms (AM), first of all the green and blue-green algae. The complex of production types considered here was hence called the Algo-agro-industrial complex (AAIC). The heterogeneity of the structure of the AAIC presented obstacles that could not be always overcome successfully; it is hardly possible in this brief review to present more than the basic information on the individual parts of the AAIC and on their mutual relations. A full-length publication on the subject is being prepared. The mosaic of data compiled here is meant as a basis for further development. (Houser-ORNL)

W72-03327

NUCLEAR ENERGY FOR DESALINATION AND AGRO-INDUSTRIAL COMPLEXES IN ISRAEL,

Israel Atomic Energy Commission, Tel-Aviv.

J. Adar.

Available from the National Technical Information Service as A CONF 49 P-018, \$3.00 in paper copy, \$0.95 in microfiche. Report A/CONF.49/P/018, April 1971. 24 p, 4 tab, 6 ref.

Descriptors: *Nuclear powerplants, *Desalination plants, *Desalination processes, *Separation techniques, Sea water, Water conservation, Irrigation programs, Domestic water, Industrial water, Evaluation, Feasibility, Vapor compression, Distillation, Costs, Water demand, Water supply, Cost-benefit analysis.
Identifiers: Agro-industrial complex, Israel.

Water resources and water consumption of Israel are presented and projections show an anticipated gap between supply and demand by the end of the century. The desalination activities of Israel are reviewed including large dual-purpose plant studies and a study for a desalting power industrial complex. In the latter, an economic evaluation and a preliminary survey of process industries are reported. (Houser-ORNL)

W72-03341

3B. Water Yield Improvement

THE 1968 GRAND RIVER PROJECT-A TRIAL PROJECT IN PRECIPITATION MANAGEMENT,

South Dakota School of Mines and Technology, Rapid City. 06The 1968 Grand River Project-A Trial Project in Precipitation Management, M. R. Schock.

Available from NTIS, Springfield, Va. 22151 as AD-725 174, \$3.00 paper copy; \$0.95 microfiche. South Dakota School of Mines and Technology, Institute of Atmospheric Sciences Report 69-2, March 1969. 48 p, 17 fig, 9 tab, 12 ref, append. USNWC N6053-68-C-0920, USBR 14-06-D-5979.

Descriptors: *Cloud seeding, *Artificial precipitation, *Silver iodide, *Weather modification, *South Dakota, Methodology, Aircraft, Hydrologic data, Rainfall, Hail, Cloud physics, Meteorology, Statistical methods.
Identifiers: *Grand River project (SD), Random methods.

A trial program in precipitation management conducted in northwestern South Dakota in 1968 included cloud seeding under operational conditions and the testing of effects of heavy silver iodide seeding upon rainfall and hailfall in and downwind of a designated target area. Randomization was not employed. Aircraft seeding was used exclusively, and approximately 210 hours of flight time were logged on seeding missions. Seeding devices included pyrotechnics and acetone generators. Substantial areas downwind of the target areas received 2 to 4.5 times their normal precipitation during July and August. However, an overall view for the season does not show the same anomaly. It was concluded that reasonable progress toward the determination of precipitation effects due to seeding over large areas can only be achieved through the use of randomization. (Woodard-USGS)

W72-02968

SANTA BARBARA PYROTECHNIC SEEDING DEVICE TEST PROGRAM, 1969-70 SEASON AND 1967-70 SUMMARY (FINAL REPORT),
North American Weather Consultants, Goleta, Calif.

R. D. Elliott, and J. R. Thompson.

Available from NTIS, Springfield, Va 22151 as AD-723 842 price \$3.00 paper copy, \$0.95 microfiche. North American Weather Consultants

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B—Water Yield Improvement

Report No 6-106, August 1970. 85 p, 13 fig, 21 tab, 8 ref, 6 append. U S Naval Weapons Center Contract N00123-70-C-243.

Descriptors: *Cloud seeding, *Artificial precipitation, *Weather modification, *California, Heat, Convection, Methodology, Mountains, Rainfall, Cloud physics, Hydrologic data, Meteorology. Identifiers: Pyrotechnic candle, Convection bands.

Tests of the effectiveness of ground-released pyrotechnics in increasing precipitation were continued for the third consecutive winter season in the mountains and valleys of Santa Barbara County, California. A pyrotechnic candle of the LW-83 formulation was ignited just prior to and during the passage of convection bands over the seeding site. This site is on a 3500 foot ridge in the Santa Ynez mountains. The bands were detected upwind of the test area and tracked into the test area by use of telemetered rainages and weather radar. This year's (1970) sample consisted of 13 seeded and 9 non-seeded bands bringing the 3 year sample to a total of 43 seeded and 42 non-seeded bands. The evaluation of the 3 years of data indicates that bands which were seeded and were in the most seedable category produced over twice as much precipitation in several places as did non-seeded bands in the same category. All bands, regardless of seedability when seeded, produced about 50% increases over a large area of the county. A computerized seeding area of effect model was used to predict an envelope of seeding area of effects for the various statistical categories. (Woodard-USGS) W72-02969

HERBICIDAL TREATMENT EFFECT OF 2,4-D ON CARBOHYDRATE LEVELS OF ALLIGATORWEED.

Agricultural Research Service, Fort Lauderdale, Fla. Plantation Field Lab. L. W. Weldon, and R. D. Blackburn. Available from the National Technical Information Service as AD-726 368, \$3.00 in paper copy, \$0.95 in microfiche. Dept of Army, Office of Chief of Engineers, Washington, D.C. (Mimeo) May 1968. 9 p. 3 tab, 11 ref.

Descriptors: *Aquatic weed control, *Herbicides, *2,4-d, *alligatorweed, Carbohydrates, Tidal waters, Aquatic plants, Florida, Seasonal, Lentic environment, Lentic environment. Identifiers: Silvex, Ortega River (Fla), Savannah (Ga), Jacksonville (Fla).

Alligatorweed response to propylene glycol butyl ether esters of 2,4-D, applied initially at different stages of growth, to the carbohydrate levels of the underwater stems, was studied for the weed growing in a tidal area and in an area of lentic waters. Alligatorweed, a profusely growing aquatic plant, may grow completely free-floating or loosely attached, and form a mat, rooted-emersed, or in a cultivated field; the matted vegetation includes interwoven stems that have fallen prostrate onto the surface 12 to 18 inches of water. The chemical was applied at 4 and 8 pounds per acre on five application dates during a growing season at two sites. One month after initial application, the readily acid-hydrolyzable carbohydrates had been depleted by an average of 23.8% in a tidal area and 14.5% in a non-flowing area. Throughout the growing season, levels of carbohydrates were higher in a non-flowing area. The alligatorweed in the tidal area was more susceptible to herbicides. Regrowth from underwater nodes resulted in replenishment of the carbohydrates during the second month following treatment with 2,4-D. (Jones-Wisconsin) W72-03225

RESUME OF STUDIES AND CONTROL OF EURASIAN WATERMILFOIL (MYRIOPHYLLUM SPICATUM L.) IN THE TENNESSEE VALLEY FROM 1960 THROUGH 1969, Tennessee Valley Authority, Muscle Shoals, Ala. Environmental Biology Branch.

Gordon E. Smith. Hyacinth Control Journal, Vol 9, No 1, p 23-25, 1971. 1 fig, 11 ref.

Descriptors: *Chemcontrol, *Rooted aquatic plants, *Aquatic weed control, Limiting factors, Reservoirs, Diquat, Reproduction, Costs, Nutrients, Plant growth, Herbicides, 2-4-D, Rivers, Alkalinity, Water quality control. Identifiers: *Myriophyllum spicatum, Tennessee Valley, Lotus, Milfoil.

The Eurasian watermilfoil has become the most troublesome aquatic weed in TVA reservoirs. Due to its rapid rate of growth, fragmentation, migration, and establishment, heavy infestations have depressed real estate values, stopped recreational activities, clogged municipal and industrial water supply intakes, and provided mosquito breeding areas. The explosive growth and spread of watermilfoil by fragmentation seem to be by geometric progression. Trials indicate that milfoil will not grow or survive in a small pond where alkalinity is less than 20 milligrams calcium carbonate per liter. Its economic value is practically non-existent. Tests show that watermilfoil can be successfully controlled by 2,4-D herbicides under certain conditions. Data indicate that 2,4-D applied for watermilfoil control on TVA reservoirs has not produced adverse effects on aquatic fauna and water quality. Dewatering is the most effective method for milfoil control. The 6-foot wintertime water level drawdown kills all of the plants on well drained shorelines, but normal reservoir drawdown schedules are insufficient for complete control. The competitiveness between lotus (*Nelumbo lutea*) and watermilfoil is studied. Lotus might shade out milfoil, and it can be killed with smaller herbicide concentrations. (Jones-Wisconsin) W72-03230

SCREW PRESS DESIGN PARAMETERS FOR DEWATERING WATER HYACINTH (EICHORNIA CRASSIPES), Florida Univ., Gainesville. Dept of Agricultural Engineering. Jaime Cifuentes. MS Thesis in Engineering, 1971. 53 p. 11 fig, 10 tab, 18 ref.

Descriptors: *Aquatic weed control, *Dewatering, *Water hyacinth, *Design criteria, *Water quality control, Florida, Water harvesting, Mechanical engineering. Identifiers: Screw press design, Fluid expression, Compression ratios, Compression time.

The rapidly spreading weed, water hyacinth, can be controlled by a harvester and the removal costs offset by marketing the nutritional elements of the weed. The major problem in harvesting and disposing of the hyacinths is their high water content. Of the various methods of extraction, the use of the screw press is advantageous because of its continuous operation and low maintenance. An efficient screw press is simulated using various cylinders in which the radii approximate the clearance between shaft and casing. A perforated metal inner-liner represents the perforated casing. The size of the material fed to the press, and shearing action and cake rotation within the press are important factors in expression efficiency. The percent fluid expressed decreases as the cylinder radius increases and the percent open area of the liner (available drainage area) decreases. The optimum compression time (press retention time) is 40 seconds. A relation is given to calculate the rate of volume change within the press to obtain a desired degree of expression. Two empirical equations relating material pressure and cake specific volume are derived. (Jones-Wisconsin) W72-03232

AQUATIC FORAGE PROCESSING IN FLORIDA, Florida Univ., Gainesville. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05C. W72-03233

CALIBRATION OF THE BRENG CATCHMENT AND THE INITIAL EFFECTS OF AFFORESTATION, Water Research Association, Marlow (England). Resources Group.

For primary bibliographic entry see Field 02A. W72-03267

Soil Conservation Research, Training and Demonstration Center, Ootacmund (India). 06Some Results of Investigation on Hydrology of the Sub-watersheds in the Nilgiris (India). For primary bibliographic entry see Field 02A. W72-03270

PROSPECTS OF A DUAL-PURPOSE NUCLEAR PLANT FOR MEETING WATER AND POWER REQUIREMENTS OF THE GREATER KARACHI AREA, Pakistan Atomic Energy Commission, Karachi. For primary bibliographic entry see Field 03A. W72-03310

USE OF NUCLEAR EXPLOSIVES FOR WATER RESOURCES DEVELOPMENT IN ARID REGIONS, Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 08H. W72-03323

ROVI: DEVELOPMENT PROJECT FOR INTERMEDIATE CAPACITY DESALTING PLANT DRIVEN BY AN ORGANIC COOLED AND MODERATED REACTOR, Comitato Nazionale per l'Energia Nucleare, Rome (Italy). For primary bibliographic entry see Field 03A. W72-03325

THE EFFECT OF A PROLONGED 2,4-DICHLOROPHENOXYACETIC-ACID TREATMENT ON TRANSPIRATION AND STOMATAL DISTRIBUTION IN TOMATO LEAVES, Negev Inst. for Arid Zone Research, Beersheba (Israel). For primary bibliographic entry see Field 02D. W72-03430

WATER UPTAKE AND HYDROPHILY OF ASSIMILATION TISSUE OF XEROPHYTES, Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Botaniki. B. I. Scherbakov. Identifiers: Adsorption, Adaptation, Assimilation, Cytoplasmic, Desert, Drought, Hydrophily, Nonosmotic, Osmotic, Tissue, Uptake, Xerophytes.

During the period of maximum drought the uptake of water by xerophytes is accomplished mainly by osmotic absorption and the role of nonosmotic absorption is reduced to a minimum. Thus the adaptation of desert plants to drought involves regrouping or change of the means of water absorption, which indicates profound structural changes of the cytoplasm.--Copyright 1971, Biological Abstracts, Inc. W72-03503

3C. Use of Water of Impaired Quality

EFFECT OF VARIATIONS IN SALINITY AND ALKALINITY OF APPLIED IRRIGATION WATERS ON THE AMINO ACID MAKE-UP OF PHASEOLUS AUREUS, Udaipur Univ., (India). K. L. Totawat, and S. N. Saxena. Plant Soil. 34 (1): 43-47. 1971. Identifiers: Adsorption, Alanine, Alkalinity, Amino-Acid, Applied, Arginine, Aspartic-Acid, Cystine, Glutamine, Histidine, Irrigation, Lysine, Make-Up, Phaseolus-Aureus-D, Proline, Ratio, Salinity, Sodium, Threonine, Variations.

A marked decrease in the content of various amino acids was observed when the B concentration was increased from 0.5 to 2.0 ppm, particularly at a low value of SAR (sodium adsorption ratio) and a low level of conductivity. At a medium level of conductivity along with a low level of B an increase in value of SAR definitely suppressed the content of lysine, arginine plus histidine, aspartic acid plus glutamine, threonine plus alanine, proline and cystine in plants. Increase in levels of conductivity specially at a low value of SAR and a low level of B substantially affected the content of lysine, arginine plus histidine, aspartic acid plus glutamine, threonine plus alanine, proline and cystine.—Copyright 1971, Biological Abstracts, Inc. W72-03432

HIGH SALT-WATER AS A RECLAIMANT FOR ALKALI SOILS OF MYSORE STATE,
University of Agricultural Sciences, Bangalore (India). Dept. of Chemistry and Soils.
M. K. Badiger, H. M. Manjunathiah, and B. V. Venkata Rao.
Mysore J Agr Sci. 3 (4): 449-454. 1969.
Identifiers: Alkali, Exchangeable, High, India, Mysore, Permeability, Reclaimant, Reduction, Salt, Sodium, Soils.

The effect of high salt-water at 2 levels of dilution on soil reclamation as regards permeability and reduction of exchangeable Na was studied. The concentration of salts in the irrigation water from Hiriyur was of the order of 428.87 me/l; that of water used was 214.4 me/l. Salt-water containing more than 30% of its total cation concentration in the divalent form was more effective in reclamation than the conventional method of gypsum application. The possibility of reclaiming alkali soils by the use of high salt water without amendments is indicated.—Copyright 1971, Biological Abstracts, Inc. W72-03449

3D. Conservation in Domestic and Municipal Use

METROPOLITAN WATER INSTITUTIONS: LEGAL AND GOVERNMENTAL STRUCTURES FOR WATER MANAGEMENT IN METROPOLITAN AREAS,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06E. W72-03294

3F. Conservation in Agriculture

EVAPORATION OF WATER AS RELATED TO WIND BARRIERS,
Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
For primary bibliographic entry see Field 02D. W72-02971

FERTILIZING AS A FUNCTION OF IRRIGATION,
Palermo Univ. (Italy).
G. P. Ballatore, and E. Zanini.
Ann Fac Agr Rasse Quadrimestrale Univ Catt Sacro Cuore. 9 (2): 207-225. 1969. French and English summaries.
Identifiers: Balanced, Climate, Density, Environment, Fertilizing, Function, Ion, Irrigation, Plant, Soil.

A close interaction exists between irrigation and the use of mineral fertilizers, the interaction being subject to the influence of climatic factors, the complex properties of the soil, the crop being cultivated and the technique of cultivation. Irrigation and fertilization must be such as to safeguard the structure of the soil by maintaining a balanced ion environment. The effectiveness of irrigation depends on the supply of minerals in the soil and vice

versa. Within certain limits interaction between irrigation and fertilization increases considerably with the density of plants.—Copyright 1971, Biological Abstracts, Inc. W72-02978

ARTIFICIAL SELECTION FOR SEEDLING DROUGHT TOLERANCE AND ASSOCIATION OF PLANT CHARACTERISTICS OF LEHMANN LOVEGRASS,
Agricultural Research Service, Tucson, Ariz. Plant Science Research Div.
L. Neal Wright, and S. E. Brauen.
Crop Sci. 11 (3): 324-326. 1971.
Identifiers: Anther, Artificial, Association, Chromosome, Color, Drought, Eragrostis-Lehmanniana-M, Foliage, Grass-M, Growth, Lehmann, Love, Number, Plant, Seed, Seedling, Selection, Tolerance, Weight.

Variability among lines of Lehmann lovegrass, *Eragrostis lehmanniana* Nees, was present for all plant and seed characteristics and responses studied. The use of program-controlled environment was confirmed to consistently evaluate large numbers of seedlings and to select genotypes which are superior for seedling drought tolerance. There was a lack of uniform association among lines for growth habit; foliage color; anther color; chromosome number; seed dormancy, weight, size, and color; and seedling drought tolerance. No single characteristic is adequate as a criterion of selection for seedling drought tolerance. Lines with nondormant seed of heaviest seed weight could be discarded as drought susceptible lines before critical evaluation and selection for seedling drought tolerance.—Copyright 1971, Biological Abstracts, Inc. W72-02980

WEATHER AND TECHNOLOGY IN THE PRODUCTION OF CORN IN THE U.S. CORN BELT,
Iowa State Univ., Ames. Dept of Agronomy.
Louis M. Thompson.
Agron J. 61 (3): 453-456. Illus. 1969.
Identifiers: Belt, Corn, Corn-M, production, Rainfall, Technology, Temperature, Weather, Yield.

The influence of weather was separated from the influence of technology on the yield of corn by the use of time trends for technology and multiple curvilinear regression for weather variables in 5 Corn Belt states. A time trend from 1930 to 1960 indicated an average annual increase of 51 kg of grain per ha. A time trend from 1960 to 1967 indicated an average annual increase of 201 kg of grain per ha. Weather variables accounted for most of the variation from the time trends. Average June temperature appeared optimum for corn while below-average temperatures in July and Aug. were associated with highest yields. Average precipitation from Sept. through June appeared optimum for corn, but highest yields were associated with above-average rainfall in July. The influence of Aug. rainfall was not significant.—Copyright 1971, Biological Abstracts, Inc. W72-02981

SOIL WATER SUPPLY AND DEPLETION PATTERN DIFFERENTIATE AMONG ZEA MAYS L. SINGLE AND DOUBLE-CROSS HYBRIDS,
Agricultural Research Service, State College, Miss.
R. R. Bruce, J. O. Sanford, C. O. Grogan, and D. L. Myhre.
Agron J. 61 (3): 416-422. Illus. 1969.
Identifiers: Cross, Depletion, Differentiate, Double, Drought, Hybrids, Irrigation, Pattern, Soil, Water, Yield, Zea-Mays-M.

The relationship of irrigation response of several double and single-cross Zea mays L. hybrids to inbred line composition and effectiveness in supplying the plant water requirements from the soil water supply was investigated. An experiment in-

volving 25 double-cross hybrids showed that 16 of these hybrids gave a 10% or greater grain yield response to irrigation, whereas the remainder showed very little or no yield increase. Certain hybrids produced about as well without irrigation as the highest yielding irrigation-responsive hybrids. Subsequent experiments examined the irrigation response of several single-cross hybrids and their double-cross products. In a season of severe drought requiring major irrigation, yield response of the double-cross products to irrigation was predicted very well by averaging the yield response of the 4 non-parental single crosses of the 4 inbreds involved. Examination of the soil water depletion pattern of single-cross hybrids has shown that the yields are related to the capability of the plant to meet its water requirements during the critical fruiting period from existing soil water supply. Cited as examples are the cytoplasmic male-sterile versions of several single crosses which rather consistently yield better than their fertile counterparts.—Copyright 1971, Biological Abstracts, Inc. W72-02983

BREEDING DWARF VARIETIES OF RICE FOR TOLERANCE TO DEEP WATER,
Ministry of Agriculture, Bangkok (Thailand). Rice Dept.
Asanee, Yantasast, Chai, Prechachat, and Ben R. Jackson.
Thai J Agr Sci. 3 (2): 119-133. Illus. 1970.
Identifiers: Breeding, Deep, Dwarf, Rice-M, Thailand, Tolerance, Varieties.

Forty-four experimental lines of dwarf rice originating from a cross between the Thai floating variety 'Leb Mue Nahng 111' and a short experimental line from the IRRI (International Rice Research Institute) were evaluated under field conditions for their tolerance in deep water. All lines were superior to 'IR8', 'IR95', 'IR5', and the tall non-floating Thai varieties in their ability to elongate. 'IR8', 'IR95', and 'IR5' were eventually destroyed by the deep water whereas the experimental lines continued to grow well. The results suggest that short-height varieties tolerant to deep water could be developed for the flood plain areas of Thailand.—Copyright 1971, Biological Abstracts, Inc. W72-02984

INFLUENCE OF DROUGHT STRESS ON FEMALE GAMETOPHYTE DEVELOPMENT IN CORN (ZEA MAYS L.) AND SUBSEQUENT GRAIN YIELD,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
G. I. Moss, and L. A. Downey.
Crop Sci. 11 (3): 368-372. 1971.
Identifiers: Corn-M, Development, Drought, Embryo, Female, Gametophyte, Grain, Sac, Stress, Yield, Zea-Mays-M.

Many abnormal embryo sacs (43% of the total observed) were recorded in ears from corn plants that had been drought stressed twice over a period of 10 days during embryo sac formation (treatment T3). Also, hermaphrodite spikelets were commonly observed. Very few grains were produced by these plants. In ears of plants drought stressed once over a period of 5 days during embryo sac formation (treatment T2), 15% of the observed embryo sacs were abnormal compared with only 2.5% in ears of the unstressed control plants. The grain yield of T2 plants was not significantly reduced. Both T2 and T3 treatments greatly delayed silking; in the former there was a lag of 13 days between anthesis and silk emergence, and 16 days in T3 as compared to 3 days in the controls. Plants were hand-pollinated to prevent sterility caused by the lack of pollen during silking, so that the large reduction in grain yield by treatment T3 was due mostly to embryo sac abortion. The surmise that femaleness of corn plants was reduced by drought stress because of a reduction in auxin

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levels was discussed.—Copyright 1971, Biological Abstracts, Inc.
W72-02985

EFFECT OF INITIAL SEED MOISTURE CONTENT ON EMERGENCE AND YIELD OF GRAIN SORGHUM,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
J. C. Phillips, and V. E. Youngman.
Crop Sci. 11 (3): 354-357. 1971.
Identifiers: Delayed, Dryland, Emergence, Grain, Moisture, Protrusion, Radicle, Seed, Sorghum-Bicolor-M, Sorghum-M, Yield.

Emergence and yield of grain sorghum (Sorghum bicolor (L.) Moench) were studied as affected by the moisture content of seeds at sowing time. Sorghum seed sown with 8% moisture content emerged less than seed sown with either 11 or 14% moisture. Low initial seed moisture content and low substrate temperatures resulted in delayed radicle protrusion from the pericarp as well as a decrease in seed respiration rate during imbibition. Effects on emergence were great enough to be reflected in grain yields, especially under dryland conditions.—Copyright 1971, Biological Abstracts, Inc.
W72-02986

SELECTIVITY OF SOME NEW HERBICIDES FOR DIRECT-SEEDED FLOODED RICE IN THE TROPICS,
International Rice Research Inst., Los Banos, Laguna (Philippines).
S. K. De Datta, and P. C. Bernasor.
Weed Res. 11 (1): 41-46. 1971. French and German summaries.
Identifiers: Acetanilide, Benthiocarb, Butoxymethyl-2-Chloro-2, Control, Diethyl, Direct, Echinochloa-Crus-Galli-M, Flooded, Herbicides, N, New, Rice-M, Seeded, Selectivity, Tropics.

Granular formulations of several new herbicides were tested for control of weeds in direct-seeded tropical rice. S- (4-chlorobenzyl)-N,N-diethylthiocarbamate (benthiocarb) and N- (butoxymethyl)-2-chloro-2,6-diethylacetanilide (CP 53619) showed a high degree of selectivity between rice and weed seedling. Applied 6 days after seeding, when grass weeds were at the 1-2-leaf stage, both herbicides gave excellent control of Echinochloa crus-galli and other weeds, and caused little or no damage to rice cv. IRR22.—Copyright 1971, Biological Abstracts, Inc.
W72-02987

MICROENVIRONMENT AND PLANT CHARACTERISTICS OF CORN (ZEA MAYS L.) PLANTED AT TWO ROW SPACINGS,
Bogor Agricultural Univ. (Indonesia).
F. Rumawas, B. O. Blair, and R. J. Bula.
Crop Sci. 11 (3): 320-323. 1971.
Identifiers: Air, Carbohydrates, Carbon, Corn-M, Di, Environment, Micro, Oxide, Plant, Planted, Row, Soil, Spacings, Temperature, Wind, Zea-Mays-M.

Development and yield of hybrid corn planted at 50- and 75- cm row spacings and thinned to final stands of 44,000 plants/ha were studied. Micrometeorological parameters were recorded during the 3 wk before and 3 wk after anthesis. Carbohydrate levels of ear leaves were determined during the same period. Temperature, precipitation and solar radiation levels during the 1967 growing season were below recorded normals. Air and soil temperatures, dew point temperatures, wind speeds, and CO₂ concentrations were similar at all canopy heights for the 50- and 75- cm row spacings. Likewise, the daily maximums and minimums for the above listed parameters occurred at approximately the same time in the 2 row spacings. Carbohydrate percentages of plants grown in 50- or 75- cm row spacings were similar. For both row spacings, diurnal changes in car-

bohydrate concentration were highly significant. Concentration of water-soluble carbohydrates increased considerably during anthesis and early ear formation. Acid-soluble carbohydrate concentration decreased during this same period. Under the climatic conditions of the 1967 growing season a wider row spacing resulted in better yield performance although these differences were not statistically significant.—Copyright 1971, Biological Abstracts, Inc.
W72-02988

EFFECT OF LEAF PUBESCENCE ON TRANSPIRATION, PHOTOSYNTHETIC RATE AND SEED YIELD OF THREE NEAR-ISOGONIC LINES OF SOYBEANS,
Pahlavi Univ., Shiraz (Iran). Dept. of Crop Science.
For primary bibliographic entry see Field 02D.
W72-02989

WATER STRESS EFFECTS ON PHOTOSYNTHESIS AND STEM DIAMETER IN SOYBEAN PLANTS,
Ohio Agricultural Research and Development Center, Wooster.
L. H. Chen, H. J. Mederski, and R. Bruce Curry.
Crop Sci. 11 (3): 428-431. 1971.
Identifiers: Bean-D, Diameter, Linear, Photosynthesis, Plants, Soy, Stem, Stress, Tension, Transducer, Xylem.

The use of a linear transducer for detecting the growth of soybean (Glycine max) stems of plants undergoing and recovering from internal water stress was investigated. Continuous, simultaneous measurements indicate a close correspondence in the behavior of plant water stress, net photosynthesis and stem diameter. Plant water stress produces relatively large, transient changes in stem diameter which obscure the effect of water stress on real growth. The close correlation between changes in stem diameter, reflecting xylem tension, and leaf water stress indicates that the linear transducer would be useful for indicating changes in plant water stress.—Copyright 1971, Biological Abstracts, Inc.
W72-02990

EFFECT OF SEED SIZE UPON RATE OF GERMINATION IN SOYBEANS,
Agricultural Research Service, Stoneville, Miss. Crops Research Div.
Calton J. Edwards, Jr., and Edgar E. Hartwig.
Agron J. 63 (3): 429-430. Illus. 1971.
Identifiers: Beans-D, Germination, Glycine-Max-D, Moisture, Rate, Seed, Size, Soil, Soy.

The rate of emergence of near-isogenic soybean (Glycine max (L.) Merr.) lines that differed in seed size was measured when germinated in Sharkey clay at moisture levels of 20, 22.5, 25, 27.5 and 30%. Weight/100 seed of lines used was 9.5 g, 13.6 g, and 22.6 g. No emergence was observed at 20% moisture. The small and medium seed size gave more rapid emergence and greater root development than the large seed at each soil moisture level where germination occurred.—Copyright 1971, Biological Abstracts, Inc.
W72-02991

TEST WITH LATER ADDITIONAL FERTILIZATION AND IRRIGATION IN THE PANNONIC SUGAR BEET CULTIVATION AREA IN AUSTRIA,
Zuckerforschungs-Institut, Fuchsenbühl (Austria).
H. J. Mueller.
Bodenkultur. 21 (4): 335-356. 1970. English summary.
Identifiers: Austria, Beet-D, Cultivation, Fertilization, Irrigation, Mineral, Moisture, Nutrition, Pannonic, Sugar, Temperature, Test, Yield.

Winter moisture, rain from April to Sept. and the average temperature minima in July and Aug. were

most essential for yield and quality, and so were the carbonate and humus content, the exchangeable Na and Mg, P₂O₅ and K₂O. Late fertilization with PK improved the natural alkalinity, partly increased the sugar content and partly diminished the detrimental effects of late N-fertilization. Nitramonol (NAC) plus PK had a slightly negative influence on the beet yield, but increased the Na and K content. NaNO₃ plus PK increased beet yield as well as the alkali content. The results obtained on the light soil of Glinzendorf deviated strongly from those obtained at the other places. NAC and NaNO₃ plus PK had a positive influence on the beet yield. Positive deviations were especially frequent in the sugar content. The favorable influence of PK on polarization appeared particularly in correlation with irrigation.—Copyright 1971, Biological Abstracts, Inc.
W72-02992

SOIL WATER CHANGES UNDER FALLOW.-CROP TREATMENTS IN RELATION TO SOIL TYPE, RAINFALL AND YIELD OF WHEAT,
Adelaide Dept. of Agriculture (Australia).
J. E. Schultz.
Aust J Exp Agr Anim Husband. 11 (49): 236-242. Illus. 1971.
Identifiers: Australia, Crop, Fallow, Rainfall, Relation, *Soil, Type, *Wheat-M, Yield.

Soil water changes under fallow (initial cultivation in spring), grassland (initial cultivation in autumn) and the succeeding wheat crops were recorded at 2 to 3 weekly intervals in 3 consecutive seasons in 3 soil types representing the range of wheat-growing soils in South Australia. Differences in water content between the 2 treatments developed soon after the start of fallowing due to the greater loss of water from grassland in spring. Rainfall during the fallow period contributed little to soil water storage except in 1 yr when heavy spring rains were recorded. In some instances the water content in the fallowed soils at seeding was less than at the start of fallowing, but the fallowed soils consistently retained more water than the grassland soils. Soil water contents decreased after Aug. of the crop year (end of tillering) and by harvest the wheat crops had commonly dried the soil to a depth of 150 cm. Fallow crops used more water and produced significantly higher wheat yields with a greater efficiency of water use in all trials.—Copyright 1971, Biological Abstracts, Inc.
W72-03015

THE HORTICULTURE IN SOME REGIONS OF ANGOLA,
Instituto de Investigacao Agronomica de Angola, Luanda.
Carlos M. Portas.
Agron Angolana. 29: 119-127. 1969. French and English summaries.
Identifiers: Angola, Heat *Horticulture, Rainfall, Temperature, Units.

The local climatic data, temperature, rainfall, rainy season and heat units, are characterized, and the vegetables are classified according to climatic adaptation. For the highlands, cold season vegetables grow well around the year with an adequate number of anticyclonic sprays during the rainy season; there are only a few days of frost. In the north and center coastal plains the climate is most suitable for warm season and megathermic vegetables. The south coast plains have a mild winter Mediterranean type climate, where high quality vegetables may grow all year.—Copyright 1971, Biological Abstracts, Inc.
W72-03028

COTTON RESEARCH ON THE M. BARALI IRRIGATION SCHEME, TANZANIA, 1957-1966,
Lowveld Experiment Station, Big Bend (Swaziland).
J. S. Watson, and F. E. Tollervey.
Cotton Growing Rev. 48 (2): 85-95. Map. 1971.
Identifiers: Barali, Control, *Cotton, Heliothis-Armigera, *Irrigation, M, Soil, Tanzania.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

The following recommendations were made for cotton growing in the region: seed should be down with the 1st good Dec. rains, the heavier soils should be avoided because of waterlogging, plant spacing should be 0.9 x 0.3 m with 1 or 2 plants per stand, insecticides should be applied for American bollworm (*Heliothis armigera*) control, and irrigation should be applied only if conditions are very dry and then sparingly.—Copyright 1971, Biological Abstracts, Inc.
W72-03041

THE INFLUENCE OF WATER ON YIELD COMPONENTS OF WHEAT,
Ministry of Agriculture, Salisbury (Rhodesia).
Salisbury Research Station.
J. H. Wilson.
Rhodesian J Agric Res. 7 (2): 129-133. Illus. 1969.
Identifiers: Components, Developmental, Differential, Sensitivity, *Wheat-M, Yield.

An isolated period of severe soil water stress (drier than wilting point for 8 days) had no depressing effects on grain yield when applied to wheat before ears emerged. The sensitivity of the crop to this degree of water stress increased after ear emergence, being most acute over the grain-filling, or dough, stages with yields depressed by as much as 80%. Sensitivity decreased as maturity was approached. A dry soil-water regime before ears emerged had little effect on ear or grain number but resulted in heavier grain than that from a wet regime over this period. Dryness after the start of ear emergence gave less ears and grain as well as lighter grain at harvest. The greatest yield was obtained from a regime which was dry before ear emergence and wet thereafter.—Copyright 1971, Biological Abstracts, Inc.
W72-03043

THE EFFECT OF IRRIGATION AND FERTILIZER TOPDRESSING ON FLUE-CURED TOBACCO: I. YIELD, QUALITY AND CHEMICAL COMPOSITION OF CURED TOBACCO,
South African Sugar Association, Natal (South Africa).
H. Rostron, and D. A. Baxter.
Rhodesian J Agric Res. 8 (2): 101-106. 1970.
Identifiers: Aroma, Chemical, Chloride, Composition, Cured, Fertilizer, Flue, *Irrigation, Nicotine, Nitrogen, Potassium, Sugar, Texture, Tobacco-D, Top-Dressing, Yield.

Yield and quality were measured in 3 annual field experiments and cured leaves from different parts of the plant were assessed for body, grain, texture and aroma. Laminae of cured leaves were analyzed for total N, K, chloride, nicotine and sugar content, and filling value was determined. Irrigation greatly improved both yield and quality when seasonal rainfall was 14 in and drought was prolonged, but it had little effect either in a yr with similar but better distributed rainfall, or when rainfall was 28 in. Irrigation within 5 wk of transplanting decreased the yield of saleable tobacco from 2397 to 2028 lb per acre; topdressing with 30 lb N and 75 lb K had no effect on this. Topdressing irrigated plants with N decreased overall quality by increasing the amount of unsaleable tobacco. Potassium topdressing had no effect on yield, quality and chemical composition. Irrigation decreased the N and nicotine contents of most leaves and increased the K, P and chloride contents of lower leaves in the 2 dry yr. Poor aroma, which was associated with poor growth and was not directly related to the chloride content of the cured leaves, was prevented in 2 yr by topdressing with N.—Copyright 1971, Biological Abstracts, Inc.
W72-03045

MESQUITE AND HUISACHE. SOME ASPECTS OF THE ECONOMY, ECOLOGY AND TAXONOMY OF THE GENERA PROSOPIS AND ACACIA IN MEXICO,
Federico Gomez Lorence, Jacqueline Signoret Poillon, and Maria Del Carmen Abuin Moreiras.

Ediciones del Instituto Mexicano de Recursos Naturales Renovables, A. C.: Mexico City, Mexico. 1970. 192 p.
Identifiers: Acacia-D, Book, Distribution, Ecology, Economy, Essential, Fodder, Genera, Huisache-D, Mesquite-D, Mexico, Oil, Prosopis-D, Taxonomy, Wood.

This work is directed to botanists, ecologists, chemists, farmers, livestock breeders, and lumbermen in order to fill gaps in the present knowledge of these 2 important but poorly known trees. The importance of the mesquite economically is considered first, noting their importance as fodder for cattle, wood and as sources of essential oils for use in perfumes and other chemical products. Next, ecological characteristics of mesquite land is considered, citing distribution, topographical, climatological, geographical and socio-economic factors. The last section of the book includes the distribution, taxonomy and possible improvement of huisache. The text is illustrated by numerous distribution maps, charts and descriptive drawings. An extensive bibliography concludes the account.—Copyright 1971, Biological Abstracts, Inc.
W72-03046

CALCIUM TRANSLOCATION IN THE PEANUT (ARACHIS HYPOGAEA L.),
Clemson Univ., S.C. Dept. of Horticulture.
B. J. Skelton, and G. M. Shear.
Agron J. 63 (3): 409-412. 1971.
Identifiers: Arachis-Hypogaea-D, Auto, Calcium, Development, Fruit, Nutrients, Peanut-D, Radiography, Stream, Translocation, Transpiration.

Fruiting peanut plants were grown in pots of soil with some roots extending through the drainage hole into jars of water. Supplying 45Ca to the water in these jars for 2 to 4 days resulted in Ca uptake and translocation primarily to the vegetative portions of the plants, as measured by autoradiographs. When the fruits were lifted from the fruiting medium and exposed to the atmosphere to promote water loss from transpiration, radioactive calcium moved readily into them, while only traces of 45Ca were detected in fruit remaining in the soil. Peanut plants were grown so that the fruiting medium, consisting of nutrient free sand, was isolated from the rooting medium to study the effects on fruit development of varying water and Ca in the fruiting zone. Omission of water or intermittent watering of the fruiting medium resulted in an increased percentage of dead gynophores (pegs or fruiting stalks). Omission of Ca and/or water decreased the percentage of fruit containing seed, and also reduced the number of 2-segmented fruit. Ca content of both pericarp and seed was decreased by omitting Ca and/or water from the fruiting medium. Intermittent drying of a Ca-free fruiting medium did not result in an increased movement of Ca into the fruit from the vegetative part of the plant, as compared with fruit in a continually moist Ca-free medium.—Copyright 1971, Biological Abstracts, Inc.
W72-03047

DDT AND TOXAPHENE MOVEMENT IN SURFACE WATER FROM COTTON PLOTS,
North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W72-03059

SUGAR BEET RESPONSE TO DEEP TILLAGE, NITROGEN, AND PHOSPHORUS ON PULLMAN CLAY LOAM,
Southwestern Great Plains Research Center, Bushland, Tex.
A. C. Mathers, G. C. Wilson, A. D. Schneider, and Paul Scott.
Agron J. 63 (3): 474-477. 1971.
Identifiers: Aeration, Beet-D, Beta-Vulgaris-D, Bulk, Clay, Deep, Density, Intake, Irrigation, Loam, Nitrogen, Phosphorus, Pullman, Sugar, Tillage, Yield.

Sugarbeet (*Beta vulgaris* L. cv. 'HH-10') yields were increased by deep tillage and added N with adequate irrigation, but there was no yield increase from applied P. Deep tillage increased yields more where N was applied. Also, the response to N was greater after deep tillage to 40 cm. Deep tillage increased the water intake rate, thus favoring good root development during wet seasons. Higher sugar yield after deep tillage was attributed to increased water intake, improved aeration, reduced bulk density, less root rot, and increased response to N.—Copyright 1971, Biological Abstracts, Inc.
W72-03083

TURBULENT TRANSPORT AND ENERGY BALANCE AS AFFECTED BY A WINDBREAK IN AN IRRIGATED SUGAR BEET (BETA VULGARIS) FIELD,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
K. W. Brown, and Norman J. Rosenberg.
Agron J. 63 (3): 351-355. 1971.
Identifiers: Balance, Beet-D, Beta-Vulgaris-D, Climate, Corn-M, Energy, Evapo, Field, Heat, Irrigated, Latent, Micro, Stress, Sugar, Transpiration, Transport, Turbulent, Windbreak.

Turbulent exchange coefficients for sugar beets sheltered by corn windbreaks and unsheltered were calculated by means of an energy balance. Occasionally measurements were made within the boundary layer characteristic of the underlying surfaces at 4 locations in shelter and in the open field. At such times the coefficients were 25% lower on the average in the sheltered area. Decreased exchange coefficient in the sheltered area acts to suppress the transport of sensible heat. The suppression of upward sensible heat transport in a Great Plains irrigated valley during the morning results in an increase in energy available for consumption as latent heat. During the afternoon, however, when sensible heat is advected to the crop, latent heat flux is lower in the sheltered crop than in the open field. Thus the total daily latent heat flux may be the same in both plots. The sheltered crop is subjected to a reduced evaporative demand, however, during periods when water stress is most likely.—Copyright 1971, Biological Abstracts, Inc.
W72-03084

MECHANISM OF WIND INJURY ON TOBACCO PLANTS: III. ON THE RELATIONSHIP BETWEEN STALK STRENGTH AND WATER CONTENT,
Okayama Tobacco Experiment Station (Japan).
Harunori Kitanosono.
Proc Crop Sci Soc Jap. 40 (1): 58-62. 1971. In Japanese with English summary.
Identifiers: Film, Injury, Mechanism, Mulching, Plants, Relationship, Stalk, Strength, Tobacco-D, Wind.

The water content of the stalk was much lower in the harvesting stage than in the early growing stage; in a rainy day it was higher than in a clear day. It was also higher in the top of the stalk than in the base. The bending showed different values with the different water content. Stalk breakage was increased when the weather was wet and loose. Damages of stalk breakage may be prevented by film mulching.—Copyright 1971, Biological Abstracts, Inc.
W72-03143

PASTO PUNA (STIPA BRACHYCHAETA GODR.) INVASION MECHANISMS: II. WEED GERMINATION IN RELATION WITH SOIL MICROENVIRONMENT,
Buenos Aires Univ. (Argentina). Facultad de Agronomía y Veterinaria.
J. Ares, L. Cazon, and Soriano Mones.
Rev Invest Agropecuar Ser 2 Biol Prod Veg. 7 (6): 289-309. Illus. 1970. English summary.
Identifiers: Alfalfa-D, Compactness, Density, Environment, Germination, Invasion, Mechanisms,

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

Micro, Moisture, Pasto-Puna-M, Plant, Relation, Soil, Stipa-Brachychaeta-M, Topography, Weed.

The relationships between plant pattern and soil microtopography, weed density and soil compactness, and depth from which seedling emerge and moisture content of the superficial soil layer (0 to 30mm) were studied. A preliminary model of weed germination and soil microenvironmental characteristics of newly established pure alfalfa crops is presented.—Copyright 1971, Biological Abstracts, Inc.
W72-03148

GEOLOGY AND WATER RESOURCES OF BON HOMME COUNTY, SOUTH DAKOTA, PART II: WATER RESOURCES,
Geological Survey, Huron, S. Dak.
D. G. Jorgensen.
South Dakota Geological Survey Bulletin 21, 1971. 61 p, 33 fig, 15 tab, 25 ref.

Descriptors: *Water resources development, *Groundwater, *Surface waters, *Hydrogeology, *South Dakota, Water yield, Water quality, Water users, Chemical analysis, Withdrawal, Groundwater recharge, Geology, Aquifers, Aquifer characteristics, Water levels, Hydrologic data, Data collections.
Identifiers: *Bon Homme County (S Dak).

Bon Homme County, an agricultural county in southeastern South Dakota, has an area of 570 square miles and a population of 8,707. Sands and sandstones of Tertiary age, sands and gravels, till, and loess of Pleistocene age, and alluvium of Holocene age overlie the Cretaceous bedrock strata throughout nearly the entire county. Water from Lewis and Clark Lake and the Missouri River is suitable for domestic and stock uses and for irrigation with only moderate leaching of the soil. The water is used by the city of Springfield and for irrigation. The quality of water from Emanuel and Choteau Creeks varies with the rate of discharge in the creeks and should not be used for irrigation on soils with poor drainage. However, the water is suitable for stock use. In Lake Henry the quality of water varies with both the season of the year and the volume of water in the lake. In particular, the water has a low sodium concentration and a variable high to very-high salinity concentration. The water is not suitable for irrigation but is suitable for domestic and stock uses. Three extensive glacial outwash aquifers are in the county. The 32-square mile Choteau aquifer is adjacent to Choteau Creek. The Tyndall-Scotland aquifer underlies an area of more than 90 square miles and extends from near Springfield to near Scotland. The Hubonmix aquifer in northwestern Bon Homme County has an areal extent of about 36 square miles. Water from these three aquifers should be used for irrigation only on land which has good soil drainage. The Codell Sandstone member of the Carlile Shale, a bedrock aquifer that commonly yields 'soft' water, is widely used as a source of domestic water. (Woodard-USGS)
W72-03153

EFFECTS OF IRRIGATION ON STREAMFLOW IN THE CENTRAL SAND PLAIN OF WISCONSIN,
Geological Survey, Madison, Wis. Water Resources Div.
For primary bibliographic entry see Field 04B.
W72-03165

TRANSPORT IN THE SOIL-PLANT-ATMOSPHERE CONTINUUM WITH PARTICULAR REFERENCE TO WATER,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02I.
W72-03173

PASTO PUNA (STIPA BRACHYCHAETA GODR.) INVASION MECHANISMS: 3. ECOLOGICAL ADJUST BETWEEN SPP. POPULATION AND MACROCLIMATE OF SANTA FE PROVINCE CENTRAL REGION: PRELIMINARY MODEL OF THE INVASION,
Buenos Aires Univ. (Argentina). Facultad de Agronomia y Veterinaria.
J. Ares, and A. Soriano.

Rev Invest Agropecuar Ser 2 Biol Prod Veg. 7 (6): 311-320. Illus. 1970. English summary.
Identifiers: Adjust, Argentina, Central, Climate, Dew, Ecological, Germination, Invasion, Macro, Mechanisms, Model, Moisture, Pasto-Puna-M, Populations, Province, Santa-Fe, Soil, Species, Stipa-Brachychaeta-M, Temperature, Weed.

The ecological relationship between soil microenvironment and weed germination, is evident when the annual variation of superficial soil moisture content, minimal soil temperatures and dew persistence are considered in connection with flushes of germination in the fields.—Copyright 1971, Biological Abstracts, Inc.
W72-03283

SUBSURFACE AND TRICKLE IRRIGATION: A SURVEY OF POTENTIALS AND PROBLEMS,
Oak Ridge National Lab., Tenn. Desalination Information Center.
E. Cole.
Available from the National Technical Information Service as ORNL-NDIC-9. \$3.00 per copy, microfiche \$0.95. Report ORNL-NDIC-9, November 1971, 68 p, 5 fig, 6 tab.

Descriptors: *Agriculture, *Agricultural engineering, *Irrigation engineering, *Desalination, *Water quality, *Water yield, *Conservation, Construction costs, Total costs, Agronomy, Water utilization, Sprinkler irrigation, Subsurface irrigation, Irrigation efficiency.
Identifiers: Trickle irrigation, Agro-Industrial complex, AEC sponsored, Israel.

Subsurface and trickle irrigation are not new ideas; however, at present in the U.S. they represent only a negligible portion of the land area under irrigation. During the past ten or twelve years a number of investigations have been made of these types of irrigation and their possible uses. Information is needed on the best types of applicators, system design, installation methods, operation, and the costs involved. The need for further development coupled with the need for extensive testing over a number of agricultural cycles, indicates that it will be several years before such systems are ready for widespread use. Even with further development of improved and less expensive equipment, the capital cost of such systems will be high. Present estimates range from \$300 to \$1000 per acre for row crops, assuming a water supply available at the site. It appears that the major application will be for high-value crops and for particular locations where water is scarce or expensive. The current use of similar irrigation in dry areas of Israel, where soil and water quality are poor, is good evidence that the high capital cost can be justified under the proper conditions. A very crude estimate of the cost of installing a subsurface-irrigation system is given. (Houser-ORNL)
W72-03314

NUCLEAR TECHNIQUES APPLIED TO THE WATER CYCLE IN AGRONOMY: REVIEW AND PROSPECTS,
For primary bibliographic entry see Field 02A.
W72-03321

THE ALGO-AGRO-INDUSTRIAL COMPLEX. AN AGRO-INDUSTRIAL COMPLEX AT NUCLEAR ENERGY CENTERS WITH AS-

SOCIATED PRODUCTION OF AUTOTROPHIC MICROORGANISMS,
Ceskoslovenska Akademie Ved, Prague. Inst. of Microbiology; and Ceskoslovenska Akademie Ved, Trebon. Lab. of Algalogy.
For primary bibliographic entry see Field 03A.
W72-03327

PROGRESS IN THE APPLICATION OF NUCLEAR METHODS IN INCREASING PRODUCTION OF RICE, SOYBEAN, AND COCONUT IN THE PHILIPPINES,
Philippine Atomic Research Center, Manila.
S. Santos.
Available from the National Technical Information Service as A CONF 49 P-748, \$3.00 in paper copy, \$0.95 in microfiche. Report A/CONF.49/P/748, May 1971. 15 p, 3 tab, 6 ref.

Descriptors: *Radiation, *Irradiation, *Radioisotopes, *Tracers, *Radioactivity effects, *Radioecology, Absorption, Irrigation, Food abundance, Productivity, Quality control, Evaluation, Benefits, Cost-benefit analysis.
Identifiers: Mutants, Genetic effect, Benefit vs. risk, Economics.

This quasi-review paper gives the highlights of progress attained up to 1970 in stimulating increased production of rice, soybean, and coconut through the application of nuclear methods in crop improvement research involving these three crop plants. The report shows improvement in mutant types with improved eating quality, yield potential, and resistance to disease. (Houser-ORNL)
W72-03337

CROP IMPROVEMENT AND FERTILIZER STUDIES INCLUDING SOIL PLANT RELATIONSHIPS USING RADIATIONS,
Bhabha Atomic Research Centre, Bombay (India). N. S. Rao, K. B. Mistry, and A. R. Gopal-Ayengar.
Available from the National Technical Information Service as A CONF 49 P-537, \$3.00 in paper copy, \$0.95 in microfiche. Report A/CONF.49/P/537, May 1971. 24 p, 81 ref.

Descriptors: *Radiation, *Irradiation, *Radioisotopes, *Tracers, *Radioactivity effects, *Radioecology, *Irrigation, Food abundance, Productivity, Evaluation, Benefits, Cost-benefit analysis.
Identifiers: Mutants, Genetic effects, Economics.

This paper reviews the current status of research involving application of radiation and radioisotopes in agricultural science in India. The main topics of concern are (1) crop improvement through mutant types to give improved eating quality, greater yield potential, and greater resistance to disease; (2) soil fertility, fertilizer use and soil-plant relations. (Houser-ORNL)
W72-03338

NUCLEAR ENERGY FOR DESALINATION AND AGRO-INDUSTRIAL COMPLEXES IN ISRAEL,
Israel Atomic Energy Commission, Tel-Aviv.
For primary bibliographic entry see Field 03A.
W72-03341

IRRIGATION EXPERIMENTS WITH BLACK CURRANTS,
State Experiment Station, Kise (Norway).
Kristian Lie Kongsrud.
Forsk Fors Landbruket. 21 (5): 465-476. 1970.
Identifiers: Berry, Black, Currants-D, Fertilizer, Growth, Irrigation, Mulch, Nitrogen, Phosphorus, Potassium, Raume, Size, Straw, Yield.

A 32 factorial plan with 5 complete replicates of the following treatments was used: V:irrigation to field capacity when soil moisture tension exceeded 0.5 bar; H:strawmulch applied annually to maintain a 10 cm cover; and N:extra N-application in

early summer as calcium nitrate. Application of a straw mulch improved soil moisture conditions compared with no mulching, due to decreased runoff and decreased evaporation. Both irrigation and mulching stimulated shoot growth, while N application had no such effect. The 1st 2 treatments also increased yield and berry size. Raceme length was increased by mulching only. In most years a significant positive correlation between yield and the previous years shoot growth was found. A positive significant interaction V X N show that the irrigation effects on both growth and yield also depends on the amount of available N in the soil. A number of treatments effect on leaf nutrient concentration were also recorded in the course of the experiment: Irrigation decreased N and increased P. Mulching increased P and K concentration, while N application had a negative effect on P. The positive effect on P and K in leaves by mulching, is considered to be a direct fertilizing effect of decomposed straw.—Copyright 1971, Biological Abstracts, Inc. W72-03418

EFFECT OF AN ASPHALT BARRIER ON SOIL WATER AND ON YIELDS AND WATER USE BY TOMATO AND CABBAGE,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
G. K. Saxena, L. C. Hammond, and H. W. Lundy. J Amer Soc Hort Sci. 96 (2): 218-222. Illus. 1971. Identifiers: Asphalt, Barrier, Cabbage-D, Irrigation, Soil, Tomato-D, Yields.

An asphalt layer, approximately 1/8-in thick placed 24-27 in deep in a Lakeland fine sand, caused water storage in the surface 24 in of soil to increase from 2 in to approximately 3 in and tomato and cabbage yields to increase by 94 and 37%. Daily water depletion rates were higher in plots treated with the asphalt barrier. During 1969, the daily average soil-water suction above the barrier (6-24 in) remained below 0.10 bar for most of the growing season, whereas it was often greater than 0.30 bar in control plots. Tomato yields were decreased linearly with an increase in the mean integrated soil-water suction (soil-water suction in 6-24 in of soil averaged for the entire growing season). Yields of tomatoes and cabbage in irrigated control plots were less than yields in non-irrigated barrier plots.—Copyright 1971, Biological Abstracts, Inc. W72-03420

ASSOCIATIONS BETWEEN PHYSICAL SOIL PROPERTIES AND SOLUBLE SOLIDS IN CANTALOUPE,
R. M. Davis, Jr., and V. H. Schweers. J Amer Soc Hort Sci. 96 (2): 213-217. Illus. 1971. Identifiers: Associations, Calcium, Cantaloupes-D, Cracking, Cucumis-Melo-D, Dehydration, Percolation, Physical, Soil, Solids, Soluble, Sulfate.

Concentrations of soluble solids (SSC) in fruits of Cucumis melo L., cv. 'PMR 45,' were positively correlated with 2 physical measures of soil samples from producing fields: a. the degree of cracking which occurred during dehydration; and b. the rapidity with which water or a CaSO₄ solution percolated the soils. Very low SSC was associated with sandy, non-cracking soils, which in addition permitted only low rates of percolation. Low SSC also was found to be associated with soils having subsurface hardpans or dense subsoil strata, and also with the distance to lower bounds of plant containers and experimentally placed barriers which obstructed downward root growth. SSC, under adverse condition, varied further as a function of fruit numbers per plant.—Copyright 1971, Biological Abstracts, Inc. W72-03421

PLANT PARASITIC NEMATODES OF FLOODED RICE FIELDS ON THE IVORY COAST: I. THE SPECIES OBSERVED,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre d'Adiopodoume.
G. Merny. Cah ORSTOM (Office Rech Sci Tech Outre-Mer) Ser Biol. 11. 3-43. Illus. 1970. English summary. Identifiers: Fields, Flooded, Ivory-Coast, Male, Malenchus-Andrassyi, Nematodes, New, Parasitic, Plant, Pratylenchus-Zeae, Rice, Species.

During 1964-1967, a taxonomic survey of plant parasitic nematodes in the flooded ricefields of 2 regions in the Ivory Coast was made. In these fields, 28 spp. belonging to the order Tylenchida and 2 spp. belonging to the order Dorylaimida were present. For 6 of these species: Hirschmanniella spinicaudata (Schuurmans Stekhoven, 1944) Luc and Goodey, 1963, Trichotylenchus rhopalocercus (Seinhorst, 1963) Seinhorst, 1968, Heterodera oryzae Luc and Berdon, 1961, H. sacchari Luc and Merny, 1963, Pratylenchus zeae Graham, 1951 and Aphelenchoides besseyi Christy, 1942, parasitism toward rice could be established. Rather large populations of some species have been studied and their original limits are enlarged. Malenchus andrassyi and the male of Pratylenchus zeae, found for the 1st time, are described and figured. Considerable differences were noticed between the 2 regions that were studied: in the northern region, the number of species encountered is relatively low and 3 among these were present in over 50% of the fields. In the central region, where the climatic conditions are different (higher relative humidity) and where rice cultivation has started more recently, more species are present and only 1 has been found in more than 50% of the fields. In the north, the nematodes are well adapted to the biotope and the fauna is well established whereas, in the central region, where the rice fields have been cultivated for a much shorter time, it is still in the process of evolution. The nematological fauna in the rice fields of Ivory Coast differs from those of the Far-East and America by the frequent presence of 2 spp. of Heterodera, which are almost absent in the other rice growing regions. Though the principal genera present in Ivory Coast are the same as those in the other rice growing areas (Tylenchorhynchus, Hirschmanniella, Helicotylenchus, Pratylenchus, Criconeimoides, Aphelenchoides, Xiphinema) they are, in general, represented by other species. Only a few species, often of secondary importance, are present in Ivory Coast as well as in other parts of the world (Tylenchorhynchus elegans, Pratylenchus zeae, Aphelenchoides bicaudatus, A. besseyi).—Copyright 1971, Biological Abstracts, Inc. W72-03422

A STUDY OF SOIL BIOASSAY TECHNIQUE USING PROMETRYNE,
Oklahoma Univ., Stillwater. Dept. of Agronomy. For primary bibliographic entry see Field 05B. W72-03427

RELATIONSHIP OF SOIL MOISTURE, TEMPERATURE AND ALKALINITY TO A SOYBEAN NODULATION FAILURE,
Department of Primary Industries, Brisbane (Australia).
A. Dlatloff. Queensl J Agr Anim Sci. 27 (3): 279-293. Illus. 1970. Identifiers: Alkalinity, Bean-D, Failure, Glycine-Max-D, Inoculum, Moisture, Nodulation, Pelleting, Relationship, Rhizobium-Japonicum, Rhizobium-Leguminosarum, Rhizobium-Meliloti, Seed, Selection, Soil, Soy, Strain, Temperature.

Desiccation of nodule bacteria in seed inocula was unlikely in soil moist enough to germinate seed. Temperatures in the seed zone differed by as much as 9C between wet and dry soil in mid-summer, 32C being the maximum recorded in wet

soil. Exposing peat-inoculated seed to 40C for 8 hr did not seriously affect nodulation by 50 and 60 deg for 4 hr did. The optimum pH for growth of Rhizobium japonicum strains was pH 6.0 with very little growth at pH 8.5 or pH 9.0. Strains of R. meliloti, R. leguminosarum, and R. japonicum (serotype 135) showed a higher tolerance to alkalinity in survival tests than did other random strains of R. japonicum. Seed pelleting with acidic materials gave better nodulation than with alkaline materials, lime having a suppressing effect. Soil temperatures, although not the main cause, could lead to nodulation failure when coupled with soil alkalinity influences. Rhizobium strain selection in the field, higher inoculum levels and seed pelleting were the most promising approaches to its solution.—Copyright 1971, Biological Abstracts, Inc. W72-03428

TOP WILTING IN ASPARAGUS,
Research Station for Outdoor Vegetable Growing in the Netherlands, Alkmaar.
J. M. M. Van Bakel, and Josephina J. A. Kerstens. Neth J Plant Pathol. 77 (2): 55-59. Illus. 1971. Identifiers: Asparagus-Officinalis-M, Holding, Index, Top, Wilting.

Wilting and dying off of young shoots of the '2nd flush' of asparagus are typical symptoms of one of the soil-borne diseases of this crop. Fungi could not be isolated from these shoots. A positive correlation was found between an increase of the pF-value water holding index of the soil and the occurrence of 'top-wilting'.—Copyright 1971, Biological Abstracts, Inc. W72-03429

SOIL LANDSCAPES AND POTENTIAL LAND USE IN THE CENTRAL PLAIN,
Food and Agriculture Organization of the United Nations, Bangkok (Thailand).
For primary bibliographic entry see Field 04A. W72-03445

ADVANCE OF IRRIGATION WATER ON THE SOIL SURFACE IN RELATION TO SOIL INFILTRATION RATE: A MATHEMATICAL AND LABORATORY MODEL STUDY,
For primary bibliographic entry see Field 02G. W72-03446

WATER MOVEMENT IN WELL DRAINED VOLCANIC ASH SOILS,
Hokkaido National Agricultural Experiment Station, Sapporo (Japan).
For primary bibliographic entry see Field 02G. W72-03447

EVAPORATION AND PRECIPITATION POTENTIAL AND WATER BALANCE IN THE STATE OF CEARA,
Escola Agron., Univ. Fed. Ceara Fortaleza, Ceara, Braz.
Zairo Ramos Silva. Bol Cearense Agron. 10: 47-51. Illus. 1969. English summary. Identifiers: Balance, Brazil, Ceara, Evaporation, Potential, Precipitation.

The soil was considered as a reservoir of water with a capacity of 125 mm for crops. The analysis of the results indicates the water availability for crops in each of 7 counties.—Copyright 1971, Biological Abstracts, Inc. W72-03448

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

SEEPAGE BENEATH HOOVER DIKE, SOUTHERN SHORE OF LAKE OKEECHOBEE, FLORIDA,
Geological Survey, Tallahassee, Fla.
F. W. Meyer.

Florida Bureau of Geology Report of Investigations No 58, 1971. 98 p, 41 fig, 9 tab, 39 ref.

Descriptors: *Underseepage, *Dikes, *Lakes, *Water levels, Florida, Reservoir leakage, Water users, Flood protection, Hydraulics, Flow nets, Canals, Transmissivity, Groundwater movement, Aquicludes.
Identifiers: *Lake Okeechobee (Fla), Hoover Dike, Everglades.

Future water needs in southern Florida call for an increase in the storage capacity of Lake Okeechobee. Seepage from the lake is expected to increase as a result of raising the lake level. To describe the manner in which seepage occurs and to develop a relation between the lake level and water levels landward of the Hoover Dike, intensive studies were made so that predictions can be made of seepage at a lake level 2.5 ft higher than the existing level. At five sites along the southern shore of Lake Okeechobee between the Caloosahatchee Canal and the St. Lucie Canal seepage occurs chiefly through beds of shell and limestone which underlie the dike at shallow depth. Seepage rates range from about 0.1 to 0.9 cfs per mile per foot of head across the dike. Seepage beneath the 50-mile length of dike should increase from 22 to 50 cfs if the average stage of the lake is raised from 14 to 16.5 feet. Most of the seepage from the lake can be controlled by properly spaced toe ditches which would intercept the seepage and return it to the lake. (Lang-USGS) W72-02954

CHANGES IN WATER QUALITY PARAMETERS OF RESERVOIRS DURING REGULATED FLOW CONDITIONS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W72-02972

THE PROBLEM OF PASTURE AND FOREST LIMITS IN THE LIGHT OF RECENT VIEWS ON MANAGEMENT OF MOUNTAINOUS LANDS,
Polish Academy of Sciences, Warsaw. Section on Agricultural and Forestry Service.
Jan Kielbinski.
Postepy Nauk Roln. 17 (5): 67-75. Illus. 1970.
Identifiers: Fertilization, Forest, Lands, Light, *Management, Minerals, Mountainous, *Pasture, Recent, Views.

From a hydrological standpoint one of the principal purposes of forests and grasslands in mountainous regions is to assure sufficient water supplies to cover requirements of the country. Forests and their distribution in mountainous regions are principally responsible for water conditions; grasslands are of somewhat lesser importance. In view of the danger of denudation of arable lands, these should be converted into grasslands wherever possible, and mountain pastures afforested. In converting arable lands, the problem of proper organic-mineral fertilization of grasslands must be considered. Techniques of such fertilization are given. Biological transformation of mountainous regions requires cooperation of a number of spe-

cialists, such as hydrologists, foresters, soil scientists, economists, zootechnicians and grassland specialists.—Copyright 1971, Biological Abstracts, Inc.
W72-03026

THE WATER-LEVEL REGIME AND ITS ROLE IN THE OPERATION OF THE KAMA RESERVOIR (UROVENNYY REZHM I YEGO ROL' V PROTSESSAKH FORMIROVANIYA KAMSKOGO VODOKHRANILISHCHA),
Perm State Univ. (USSR). Lab. of Water Management Research.
N. B. Sorokina, and Yu. M. Matarzin.

In: Voprosy formirovaniya vodokhranilishch i ikh vliyaniya na prirodu i khozyaystvo; Perm, USSR, p 9-26, 1970. 10 fig, 3 photo, 5 tab, 7 ref.

Descriptors: *Reservoirs, *Reservoir operation, *Reservoir storage, *Reservoir stages, *Water level fluctuations, Water levels, Streamflow, Regulated flow, Regulation, Ice, Seasonal, Navigation, Probability.
Identifiers: *USSR, Perm Oblast, Kama River, Kama Reservoir, Reservoir regulation.

Water-level regime characteristics of the Kama Reservoir (Perm Oblast) were examined in relation to the regulation of streamflow by the hydroelectric powerplant and in connection with updating plans for its operation. Emphasis is placed on the need for a detailed analysis of water-level fluctuations to determine the effects of reservoir regulation on changes in the natural conditions of the adjacent area and on downstream navigation. Analysis of the water-level regime of the reservoir for the period of operation 1956-1968 is based on records furnished by the Perm Hydrometeorological Observatory. (Josefson-USGS)
W72-03073

EFFECT OF THE KAMA RESERVOIR ON GRASSY VEGETATION IN THE HIGH WATER-TABLE ZONE (VLIYANIYE KAMSKOGO VODOKHRANILISHCHA NA TRAVYANUYU RASTITEL'NOST' ZONY PODTOPLENIYA),
Perm State Univ. (USSR). Lab. of Water Management Research.
N. B. Sorokina, M. M. Danilova, and Yu. M. Matarzin.

In: Voprosy formirovaniya vodokhranilishch i ikh vliyaniya na prirodu i khozyaystvo; Perm, USSR, p 85-96, 1970. 3 fig, 6 photo, 2 tab, 17 ref.

Descriptors: *Vegetation, *Grasslands, *Grasses, *Water table, *Reservoirs, Reservoir construction, Groundwater, Soils, Shore-line cover, Legumes, Clovers, Fescues, Orchardgrass, Bluegrasses, Mosses, Cattails, Marsh plants, Summer.
Identifiers: *USSR, Perm Oblast, Udmurt ASSR, Kama River, Kama Reservoir, Geobotany, Hygrophytes, Mesophytes, Sedges, Rushes, Meadowgrass.

The formation of phytocoenoses under the influence of the Kama Reservoir (Perm Oblast) was examined to determine the direction of development of grassy vegetation in a high water-table zone of a reservoir. The width of the zone of influence of the Kama Reservoir on grassy vegetation depends upon the structure of the valleys of the Kama River and of its tributaries and is determined by the depth of groundwater occurrence and by the mechanical properties and water-lifting capacity of the soils. The influence of the reservoir is particularly evident on low banks which have a high water table. Two clearly distinguishable subzones within the zone of influence of the reservoir were identified: (1) a subzone of strong influence where the depth to the groundwater table is 0-80 cm; and (2) a subzone of moderate influence where the depth to the groundwater table is 80-150 cm. Hygrophytes and hygromesophytes are predominant in the subzone of strong influence, while mesophytes, hygromesophytes and, occasionally, hygrophytes are common in the subzone

of moderate influence. No noticeable change in the character of the grassy vegetation was observed when the depth to the groundwater was greater than 150 cm. A high yield of legumes and grasses in the subzone of moderate influence makes it possible to plant here *Trifolium hybridum*, *Trifolium pratense*, *Lathyrus pratensis*, *Festuca pratensis* Huds., *Phleum pratense*, and *Dactylis glomerata*. (Josefson-USGS)
W72-03074

FORMATION OF SHALLOW-WATER AREAS IN KAMA RIVER RESERVOIRS (FORMIROVANIYE MELKOVOODIY KAMSKIKH VODOKHRANILISHCH),
Perm State Univ. (USSR). Lab. of Water Management Research.
Yu. M. Matarzin, and N. B. Sorokina.

In: Voprosy formirovaniya vodokhranilishch i ikh vliyaniya na prirodu i khozyaystvo; Perm, USSR, p 46-63, 1970. 3 fig, 3 photo, 8 tab, 24 ref, append.

Descriptors: *Bodies of water, *Reservoirs, *Shallow water, Shoals, Islands, Shores, Abrasion, Aggradation, Aquatic environment, Aquatic plants, Navigation.
Identifiers: *USSR, Perm Oblast, Udmurt ASSR, Kama River, Kama Reservoir, Votkinsk Reservoir, Coves.

The characteristics of shallow-water areas in the Kama Reservoir (Perm Oblast) and in the Votkinsk Reservoir (Udmurt ASSR), both on the Kama River, were examined to describe and classify their long-term dynamics of evolution under the influence of hydrodynamic and geodynamic factors. The shallow-water portion of the area of the Kamsk and Votkinsk Reservoirs is 19.3% and 14.3%, respectively. Three types of shallow waters, based on their location, were identified: (1) shallow water in coves; (2) shallow water near island shorelines; and (3) shallow water in open areas. The area of shallow water in the upper reach of the Kama Reservoir is 119.2 sq km and is distributed as follows: 40.3 sq km in coves; 14.7 sq km near islands; and 64.2 sq km in open areas. The extent of the shallow-water area in coves of the middle reach is the same as that in the upper reach, while the shallow-water area near islands and in open stretches decreases 1.5- to 2-fold. In the lower reach of the reservoir shallow water is found only in coves (8.3 sq km). Shallow-water distribution in the Votkinsk Reservoir is different from that in the Kama Reservoir and may be explained by the characteristics of the river valley structure. All three types of shallow water are found in the upper, middle, and lower reaches of this reservoir. The influence of its surrounding shoreline is most apparent in the shallow water of coves, less so in the shallow water near islands, and least apparent in the shallow water of open areas. (Josefson-USGS)
W72-03076

PROBLEMS OF RESERVOIR MORPHOMETRY AND ZONATION (VOPROSY MORFOMETRII I RAYONIROVANIYA VODOKHRANILISHCH),
Perm State Univ. (USSR). Lab. of Water Management Research.
For primary bibliographic entry see Field 02H.
W72-03077

SOME EFFECTS OF TRINCHERAS ON SMALL RIVER BASIN HYDROLOGY,
Indiana State Univ., Terre Haute, Dept. of Geography and Geology.
H. W. Dennis, and E. C. Griffin.
Journal of Soil and Water Conservation, Vol 26, No 6, p 240-242, November-December 1971. 3 fig, 10 ref.

Descriptors: *Watershed management, *Water resources development, *Water storage, *Drought tolerance, *Mexico, Water supply, Water shortage, Dams, Reservoirs, Retention, Surface waters, Groundwater recharge, Irrigation, Agriculture, Livestock.

Identifiers: *Trincheras.

In 1965 the Unidad Industriales Forestal (UIF) in Mexico built a series of trincheras across the arroyitos (small washes) draining the Pompa basin. The Pompa basin, one of several basins located on the Mesa del Huracan, attains an altitude of 7,540 feet and is connected to the Rio Largo, 325 feet below, by the narrow Arroya Pompa. The trincheras generally impound water through the winter months, November to early March. By late March seepage and evaporation reduce the water supply, and by mid-April only the largest impoundments contain water. Unless some precipitation is received, all are dry by May. The Pompa basin contains 30 acres of cultivated land and 46 acres of uncultivated mixed grazing and timber land. Much of the land now cultivated was unplantable until UIF constructed trincheras. Trincheras were placed in the Pompa basin to stabilize and prolong runoff, to raise the groundwater level, and to provide a more permanent flow of water in the Rio Largo. The reservoirs behind the trincheras provide a water supply for livestock. (Woodard-USGS)
W72-03160

OUTLET TRANSITIONS WITH TRIANGULAR-SHAPED BAFFLES,

Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 08A.
W72-03191

HERBICIDAL TREATMENT EFFECT OF 2,4-D ON CARBOHYDRATE LEVELS OF ALLIGATORWEED,

Agricultural Research Service, Fort Lauderdale, Fla. Plantation Field Lab.
For primary bibliographic entry see Field 03B.
W72-03225

EXPERIMENTAL CATCHMENTS AID INTERPRETATION OF A MORE EXTENSIVE FLOOD NETWORKS,

Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W72-03272

THE TRANSFER VALUE OF INFORMATION COLLECTED ON REPRESENTATIVE BASINS,

Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02A.
W72-03275

PROGRESS IN APPLICATION OF NUCLEAR TECHNIQUE IN GEOPHYSICS, MINING, AND HYDROLOGY IN POLAND,

Institute of Nuclear Physics, Krakow (Poland); and Institute of Nuclear Techniques, Krakow (Poland).
For primary bibliographic entry see Field 07B.
W72-03318

EURASIAN WATERMILFOIL: A NEW MENACE TO OKLAHOMA WATERS,

Oklahoma Dept. of Wildlife Conservation, Caddo. Ron Jarman.
Proc Okla Acad Sci. 49: 171-174. 1970.
Identifiers: Control, Eurasian, Menace, Myriophyllum spicatum-D, New, Oklahoma, Watermilfoil-D.

The recent spread of the exotic plant, *Myriophyllum spicatum*, has created great concern for the water resources of the eastern USA. During 1968, 4 populations of this plant were identified in both major watersheds in Oklahoma. Recommendations are given for attacking this problem.--Copyright 1971, Biological Abstracts, Inc.
W72-03412

SOIL LANDSCAPES AND POTENTIAL LAND USE IN THE CENTRAL PLAIN,

Food and Agriculture Organization of the United Nations, Bangkok (Thailand).
W. Van Der Kevie.
Thai J Agric Sci. 3 (1): 1-12. Illus. Map. 1970.
Identifiers: Central, Control, Cropping, Double, Irrigation, Land, Landscapes, Plain, Potential, Rice-M, Soil, Thailand.

The soils in the Central Plain of Thailand can be classified into 7 broad groups in regard to age, parent material and soil development. Only a very limited area is suitable for a double cropping pattern with rice in the rainy season and upland crops in the dry season. Out of a total irrigable area of 13 million rai only about 1 million rai or 8% have a potential for this type of double cropping and even of this area a large part may give serious problems due to water-logging. The potential for increased rice production, however, is very great and rice yields could be multiplied many times by improving water control in the rainy season and providing irrigation for a 2nd rice crop in the dry season.--Copyright 1971, Biological Abstracts, Inc.
W72-03445

TREES AND STREAMS: THE EFFICIENCY OF BRANCHING PATTERNS,

Geological Survey, Washington, D.C.
Luna B. Leopold.
J Theor Biol. 31 (2): 339-354. Illus. 1971.
Identifiers: Branching, Patterns, Streams, Trees.

Extending the analysis of branching patterns of the drainage net of rivers, originated by Horton, the relation of average numbers and lengths of tree branches to size of branch was investigated. Size of branch was defined by branch order, or its position in the hierarchy of tributaries. It was found that, as in river drainage nets, there is a definite logarithmic relation between branch order and lengths and numbers. This definite relation is quantitatively comparable, within limits, among river networks, tree branching systems, and several random-walk models in both 2 and 3 dimensions. Such a relation appears to be the most probable under the applicable constraints. Moreover the most probable arrangement appears to minimize the total length of all stems in the branching system within other constraints and so, to that extent, achieves a certain efficiency.--Copyright 1971, Biological Abstracts, Inc.
W72-03483

4B. Groundwater Management

GEOLOGY AND WATER RESOURCES OF BON HOMME COUNTY, SOUTH DAKOTA, PART II: WATER RESOURCES,

Geological Survey, Huron, S. Dak.
For primary bibliographic entry see Field 03F.
W72-03153

WATER-LEVEL CHANGES IN THE PERMIAN CAPITAN AQUIFER, EDDY AND SOUTHERN LEA COUNTIES, NEW MEXICO,

Geological Survey, Albuquerque, N. Mex.
W. L. Hiss.
New Mexico Professional Engineer, p 16-22, November 1971. 4 fig, 1 tab, 12 ref.

Descriptors: *Water level fluctuations, *Groundwater, *Aquifer characteristics, *New Mexico, *Observation wells, Aquifers, Withdrawal, Drawdown, Oil industry, Water quality, Geology, Oil fields, Geologic controls, Hydrologic aspects.
Identifiers: *Capitan aquifer (N. Mex.), Eddy County (N. Mex.).

Twelve observation wells were monitored in the Permian Capitan aquifer in Eddy and southern Lea Counties, New Mexico to determine the effects of fluid production from this aquifer and from rocks hydraulically connected with this aquifer. Very

small net changes in the water levels, generally due to climatic and water-use conditions in the Pecos River valley, have been noted in seven wells in Eddy County over a 3- to 4-year period. However, the water levels in five wells in southern Lea County have declined from 53 to 84 feet during the period 1967 to 1970. This is due to (1) the withdrawal of water from the Capitan aquifer in Lea County, New Mexico and Ward and Winkler Counties, Texas in connection with operations associated with the secondary recovery of oil, and (2) the production of petroleum and associated waste water from formations of Permian (Guadalupe) age that are hydraulically connected to the Capitan aquifer in this same area. (Woodard-USGS)
W72-03155

TUNNELS AND DIKES OF THE KOOLAU RANGE, OAHU, HAWAII, AND THEIR EFFECT ON STORAGE DEPLETION AND MOVEMENT OF GROUND WATER,

Geological Survey, Washington, D.C.
G. T. Hirashima.
Available from GPO, Washington, D.C. 20402 25 cents. Geological Survey Water-Supply Paper 1999-M, 1971. 21 p, 8 fig, 5 tab, 4 ref.

Descriptors: *Groundwater movement, *Impounded waters, *Water storage, *Tunnels, *Hawaii, Dikes, Reservoirs, Groundwater, Groundwater recharge, Water yield, Hydrologic data, Dewatering, Geology, Hydrogeology.
Identifiers: Oahu (Hawaii), Koolau Range.

Groundwater impounded by dikes in the Koolau Range is a major source of water for the island of Oahu, Hawaii, and many tunnels have been bored into the range to develop it. All water-development tunnels, except Waihee tunnel, have depleted storage in the rocks they penetrate and are now discharging at rates that are but fractions of the rates possible at full storage. Rocks above the floor of the water-development part of Waihee tunnel have never been completely dewatered, and storage can be manipulated by regulating outflow. Thus, storage for this tunnel can be increased during periods of low demand and discharged at high rates during periods of high demand. Mathematical analysis of the flow-recession curve of Waihee tunnel shows that (1) its recession constant is 0.00401, (2) net storage (exclusive of recharge) is 2,200 million gallons (6,800 acre-feet), and (3) initial discharge from full storage would be about 19 million gallons per day. Analysis of flow-recession curves for Waiahole ditch tunnel (main bore) and Haiku tunnel shows that these tunnels have drainage characteristics that are similar to those of Waihee tunnel. (Woodard-USGS)
W72-03162

EFFECTS OF IRRIGATION ON STREAMFLOW IN THE CENTRAL SAND PLAIN OF WISCONSIN,

Geological Survey, Madison, Wis. Water Resources Div.
E. P. Weeks, and H. G. Stangland.
Geological Survey Open-file Report, 1971. 113 p, 19 fig, 16 tab, 56 ref.

Descriptors: *Water resources development, *Environmental effects, *Water balance, *Hydraulic budget, *Wisconsin, Groundwater, Streamflow, Groundwater recharge, Water users, Irrigation, Recreation, Withdrawal, Water level fluctuations, Water table, Hydrogeology, Pumping, Aquifers, Surface-groundwater relationships, Hydrologic data.
Identifiers: *Wisconsin (Central sand-plain).

Development of groundwater for irrigation affects streamflow and water levels in the sand-plain area of central Wisconsin. This study inventories present development of irrigation in the sand-plain area, assesses potential future development, and estimates the effects of irrigation on streamflow and groundwater levels. Outwash, the main

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

aquifer, supplies water to about 300 irrigation wells and maintains relatively stable flow in the streams draining the area. The saturated thickness of these deposits is more than 100 feet over much of the area and is as much as 180 feet in bedrock valleys. The permeability of the outwash ranges from about 1,000 gpd per square foot to about 3,800 gpd per square foot. Specific capacities of irrigation wells range from 14 to 157 gpm per foot of drawdown. Annual streamflow in the area is sustained mainly by groundwater and its seasonal distribution is fairly uniform. Water levels in the headwater area are drawn down both locally near pumping wells and regionally over the headwater area. Local drawdowns are insufficient to cause excessive well interference among irrigation wells as long as the wells are spaced one-eighth mile or more apart. Acreally, water levels are drawn down by pumping for irrigation by about 0.5 foot during the summer, as compared to a 2- to 3-foot natural decline for the same period. Long-term declines in water levels are greatest in the major groundwater divide area, where they would be about 2-3 feet at the present level of development. (Woodard-USGS)
W72-03165

HYDROGEOLOGIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL, WITH A CASE STUDY IN SOUTHEASTERN WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05E.
W72-03181

EXTRAPOLATION OF RESULTS ABOUT WATERLEVEL CHANGES IN FISSURED CARBONATE ROCKS,
Research Institute for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W72-03276

SELECTED ENVIRONMENTAL STUDIES USING RADIOACTIVE ISOTOPES,
Atomic Energy Research Establishment, Harwell (England); and Water Resources Board, Reading (England).
For primary bibliographic entry see Field 05B.
W72-03336

GASOLINE IN GROUNDWATER IN LOS ANGELES COUNTY,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 05G.
W72-03353

4D. Watershed Protection

EROSION OF TUARES SOILS IN ALGERIA (OSOBENOSTI EROZII POCHV TUARES V ALZHIRE),
Tadzhik Scientific Research Inst. of Soil Science, Dushanbe (USSR).
For primary bibliographic entry see Field 02J.
W72-03071

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PRECIPITATION OF HEAVY METALS FROM NATURAL AND SYNTHETIC ACIDIC AQUEOUS SOLUTIONS DURING NEUTRALIZATION WITH LIMESTONE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05G.
W72-02956

FISH SPECIES DIVERSITY INDICES AS INDICATORS OF POLLUTION IN GALVESTON BAY, TEXAS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Timothy J. Bechtel, and B. J. Copeland.
Contrib Mar Sci. 15: 103-132. Illus. 1970.
Identifiers: Anchoa-Mitchilli, Bay, Biomass, Diversity, *Fish, Galveston, *Indicators, Indices, Pollution, Species, Texas.

Fish species diversity indices (natural belts/individual) calculated for both fish weights and numbers from trawl collections were found to be useful indicators of environmental and pollution stress in Galveston Bay, Texas. Diversity values ranged from 2.2 in the Texas City-Galveston area to 0.02 in the Houston Ship Channel. Thus it is demonstrated that the concept of using species diversity to indicate adverse water quality conditions is applicable to the higher trophic levels of an estuary. Significant differences were detected in diversity between areas of the bay within each sampling period except in winter as well as between seasons. Also, significant differences between the weight and number indices existed, indicating that both biomass and numbers of organisms should be utilized when studying the diversity of higher trophic levels. Correlation of diversity with percent waste water indicated that those areas receiving the greatest amounts of effluents and toxic materials (up to 86% effluent by volume) exhibited the lowest mean annual diversities. Fish diversity in the Houston Ship Channel above Baytown, Texas can be used to predict diversity in the bay because of the linear relationship between distance and dilution of the ship channel effluent (19% effluent by volume calculated for Bolivar Roads). Sampling throughout the system indicated that the fish populations could be divided into somewhat separate communities, each structured as a response to environmental and pollution stress. In those areas receiving the greatest stress, the bay anchovy, *Anchoa mitchilli*, was the dominant species. These same areas also supported the fewest numbers of large individuals.—Copyright 1971, Biological Abstracts, Inc.
W72-03002

APPLICATION OF THE TECHNIQUE OF SOLUBLE ULTRAFILTRATING MEMBRANES TO THE STUDY OF VIRUS IN THE WASTE WATERS OF TANANARIVE,
Institut Pasteur, Tananarive (Madagascar).
P. Coulanges, A. Mayoux, and E. R. Brygoo.
C. R. Seances Soc Biol Filiales. 164 (7): 1672-1673. 1970 (1971).

Descriptors: *Membranes.
Identifiers: Filtrating, Madagascar, Soluble, Tananarive, Technique, Ultra, Virus, Waste.

The use of ultrafiltrating membranes soluble in alginate is a simple and efficient method for investigating virus in waste waters. Used in Tananarive, it provided 43 in 100 positive isolations.—Copyright 1971, Biological Abstracts, Inc.
W72-03035

COLORIMETRIC DETERMINATION OF MANGANESE IN ANOXIC WATERS,
Woods Hole Oceanographic Institution, Mass.
P. G. Brewer, and D. W. Spencer.
Limnol Oceanog. 16 (1): 107-110. 1971.
Identifiers: Anoxic, Colorimetric, Determination, Manganese.

In the reducing environment of anoxic basins Mn (III) over (IV) is reduced to soluble Mn (II); the deep waters of the Black Sea contain up to 500 microgram Mn (II)/l, about 100 times the oceanic average. When this Mn was measured with formaldoxime, color development was erratic if the reagents were added separately. Rapid and reproducible color development was achieved by using a mixed ammonia/formaldoxime reagent added singly to the sample. Precipitation was

avoided by maintaining the pH in the range 8.8-8.9. No interferences from sulfide or dissolved salts were observed. A small correction was made for interference due to Fe. Dissolved Mn values in the Black Sea ranged from a midwater maximum of 460 microgram Mn/l to 250 microgram/l in deep water.—Copyright 1971, Biological Abstracts, Inc.
W72-03048

A GC METHOD FOR THE DETERMINATION OF NITROLITRACETIC ACID IN LAKE WATER,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.
Y. K. Chau, and M. E. Fox.
J Chromatogr Sci. 9 (5): 271-275. Illus. 1971.
Identifiers: Acetic-Acid, Chromatographic, Determination, Gas, Lake, Method, Nitrolietri.

A GC (gas chromatographic) method of determination of nitrolitracetic acid (NTA) in lake water at microgram level is described. The NTA is first concentrated or anion exchange resin, eluted with formic acid and followed by propyl esterification. The method is sensitive, specific and free from the interferences of metals and common fatty and amino acids. The sensitivity of the method is in the order of 0.01 microgram (injected) under normal instrumental operation conditions. NTA has recently been proposed as a partial substitute for polyphosphate in detergent formulation.—Copyright 1971, Biological Abstracts, Inc.
W72-03051

A SUBMERSIBLE SELF-CONTAINED WATER QUALITY METER,
Plessey Co., Ltd., Ilford (England). Environmental Sensor Div.
For primary bibliographic entry see Field 02H.
W72-03130

INFLUENCE OF MINERALOGY AND MICROORGANISMS ON IRON AND SULFIDE CONCENTRATIONS IN GROUNDWATER,
Missouri Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W72-03147

CHEMISTRY OF NATURAL WATERS -- VI. CLASSIFICATION OF WATERS,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
For primary bibliographic entry see Field 07A.
W72-03168

THE BIOASSAY OF WATER POLLUTANTS WITH CULTURED MAMMALIAN CELLS: PART II,
Rhode Island Univ., Kingston. Water Resources Center.
H. W. Fisher.
Available from the National Technical Information Service as PB-205 775, \$3.00 in paper copy, \$0.95 in microfiche. Rhode Island Water Resources Center, Kingston, Completion Report (N.D.), 17 p, 7 fig. OWRR A-030-RI (1).

Descriptors: *Bioassay, Pollutants, *Toxicity, Rotenone, Copper, Chromium, *Pollutant identification, *Metals.
Identifiers: *Mammalian cells, Zinc, Cadmium.

The increasing problem of environmental contamination by chemicals has suggested the potential usefulness of a cell bioassay system permitting the rapid screening of the toxicological properties of chemicals under standardized conditions. Using quantitative methods of mammalian cell culture, a series of preliminary investigations were carried out on a selected group of toxic chemicals. These studies demonstrated that the toxicity of all chemicals investigated could be determined with sufficient precision and sensitivity to establish a unique

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relative toxicity for each chemical and to permit an analysis of the kinetics of toxic action. In this study, bovine ovary cells plated into petri dishes were exposed to varying concentrations of rotenone, cadmium, zinc, copper, chromium, and NTA continuously for 7-9 days. The relative plating efficiency was determined and titration curves were constructed. In the kinetic phase of this study, attached cells were exposed to single concentrations of the toxic chemical for varying time intervals and the relative plating efficiency followed as a function of exposure time. The log of the surviving cell fraction was plotted against exposure time giving classical survival curves.
W72-03178

STUDIES ON ALGAE FROM EUTROPHIC AND OLIGOTROPHIC WATERS AND THEIR USE IN THE BIO-ASSAY OF WATER QUALITY,
Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
Brian Moss.
Available from the National Technical Information Service as PB-205 805, \$3.00 in paper copy, \$0.95 in microfiche. Project Completion Report 11 p. OWRR A-034-MICH (1).

Descriptors: Algae, *Nutrient requirements, Bioassay, Eutrophication, Oligotrophy, Lakes, Michigan, Bicarbonates, Iron, Phosphorus, Nitrogen, Water quality.

The nutrition of several species of algae found in eutrophic and oligotrophic lakes and the usefulness of these algae in bio-assays for detecting limiting nutrients in natural waters were investigated. The roles of bicarbonate, pH, monovalent and divalent cations, phosphorus, nitrogen and iron are discussed. (Bahr-Michigan)
W72-03183

ESTIMATING EUTROPHIC POTENTIAL OF POLLUTANTS,
Monsanta Co., St. Louis, Mo; and Washington Univ., St. Louis, Mo. Dept. of Environmental and Sanitary Engineering.
For primary bibliographic entry see Field 05C.
W72-03218

FRICTION REDUCTION BY ALGAL AND BACTERIAL POLYMERS,
Naval Undersea Research and Development Center, San Diego, Calif.
Paul R. Kenis, and J. W. Hoyt.
Available from the National Technical Information Service as AD-726 181, \$3.00 in paper copy, \$0.95 in microfiche. Report NUC TP 240, June 1971, 34 p. 18 fig. 6 tab. 20 ref. ONR NR 137-699.

Descriptors: *Hydrodynamics, *Friction, *Turbulent flow, Algae, Bacteria, Marine plants, Engineering, Water properties, Phytoplankton, Chlorophyta, Phaeophyta, Rhodophyta, Diatoms, Pyrrophyta, Chlorella, Pseudomonas, Testing, Measurement, Phycology.
Identifiers: *Biological polymers, *Friction reduction, Polysaccharides, Drag reduction.

Friction reduction phenomena, attributed to dissolved long-chain polysaccharides exuded by algae and bacteria, stimulated the investigation of the ability of biological polymers produced by seaweeds, microscopic algae, and bacteria to reduce friction in water flow, including the effect of polymers of biological origin on the reported unexplainable variations in hydrodynamic test facilities, their usability for friction-reduction application and for measurements to quantitate and characterize biological polymers. Friction-reducing materials have been found in culture media. All water samples tested from inland and marine sources gained friction-reduction ability when enriched with sugar, as a consequence of polysaccharide synthesis by bacteria, which leads to the assumption that biological polymers are the probable cause of the unexplainable variations in

hydrodynamic test facilities. Bacterial polysaccharides were more effective than seaweed extract at low concentrations for friction reduction, but both were much less effective than synthetic polymers. Turbulent-flow frictional measurements were found to be sensitive for detection, measurement, and partial characterization of long-chain polymers. The friction-reduction technique is a rapid and effective procedure for the detection and quantification of long-chain polymers. (Jones-Wisconsin)
W72-03220

INFLUENCE OF ORGANIC MATTER ON SOME CHARACTERISTICS OF AQUATIC SOILS,
Auburn Univ., Ala. Agricultural Experiment Station.
For primary bibliographic entry see Field 05C.
W72-03223

IRON-59 AS A SOLIDS TRACER IN AQUEOUS SUSPENSIONS,
Robert S. Kerr Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W72-03236

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas.
Frank H. MacDonald, Lawrence B. Sullivan, and Thomas R. Livermore.
Available from the National Technical Information Service as AD-711 328, \$3.00 in paper copy, \$0.95 in microfiche. U.S. Coast Guard Report, TI-59009-5, May 31, 1970. 193 p. 7 fig. 4 tab. U.S. Coast Guard Contract DOT-CG-90505-A.

Descriptors: *Electronic equipment, *Instrumentation, *Nitrates, *Phosphates, *Dissolved oxygen, *Data transmission, *Remote sensing, Mechanical equipment, Telemetry, Data processing, Nitrites, Silicates, Ammonia, Fluorides, Colorimetry, Automation, Polarographic analysis, Electrodes, Water temperature, Hydrogen ion concentration, Salinity, Turbidity, Waves (Water), Ocean currents, Electric power, Costs, Corrosion, Fouling, Flotsam, Calibrations, Acceptance testing, Oceanography, Buoys, Standards.
Identifiers: Photocells, Television.

This six-volume set of reports was prepared to assist the U.S. Coast Guard in maximizing the commonality of hardware and equipment used on various data-gathering platforms (manned, buoy, fixed). Volume VI covers the development of test and calibration techniques to measure sensor compliance with performance, mechanical, and electrical requirements of the U.S. Coast Guard. (Little-Battelle)
W72-03282

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas.
Robert J. Gaillard, Kenneth I. Heldebrandt, Robert M. Crosby, and Thomas Cass.
Available from the National Technical Information Service as AD-711 323, \$3.00 in paper copy, \$0.95 in microfiche. U.S. Coast Guard Contract Report, TI-59009-1b, May 21, 1970. 194 p. 1 tab. U.S. Coast Guard Contract DOT-CG-90505-A.

Descriptors: *Electronic equipment, *Instrumentation, *Nitrates, *Phosphates, *Dissolved oxygen, *Data transmission, *Remote sensing, Mechanical equipment, Telemetry, Data processing, Nitrites, Silicates, Ammonia, Fluorides, Colorimetry, Automation, Polarographic analysis, Electrodes, Water temperature, Hydrogen ion concentration, Salinity, Turbidity, Waves (Water), Ocean currents, Electric power, Costs, Corrosion, Fouling, Flotsam, Calibrations, Acceptance testing, Oceanography, Buoys, Standards.
Identifiers: Photocells, Television.

graphic analysis, Electrodes, Water temperature, Hydrogen ion concentration, Salinity, Turbidity, Waves (Water), Ocean currents, Electric power, Costs, Corrosion, Fouling, Flotsam, Calibrations, Acceptance testing, Oceanography, Buoys, Standards.
Identifiers: Photocells, Television.

This six-volume set of reports was prepared to assist the U.S. Coast Guard in maximizing the commonality of hardware and equipment used on various data-gathering platforms (manned, buoy, fixed). Volume I and II are a discussion and catalog which cover specifications of sensors for measuring optical parameters, ambient noise, conductivity and salinity, currents, depth, dissolved solids, oxygen, pH, sound velocity, waves and tides, and temperature. Considerations of signal conditioning and encoding, power supplies, and equipment costs are also included. (Little-Battelle)
W72-03286

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
Texas Instruments, Inc., Dallas.
Robert J. Gaillard, Kenneth I. Heldebrandt, Robert M. Crosby, and Thomas Cass.
Available from the National Technical Information Service as AD-711 322, \$3.00 in paper copy, \$0.95 in microfiche. U.S. Coast Guard Contract Report, TI-59009-12, May 21, 1970. 213 p. 16 fig. 37 tab. 105 ref. U.S. Coast Guard Contract DOT-CG-90505-A.

Descriptors: *Electronic equipment, *Instrumentation, *Nitrates, *Phosphates, *Dissolved oxygen, *Data transmission, *Remote sensing, Mechanical equipment, Telemetry, Data processing, Nitrites, Silicates, Ammonia, Fluorides, Colorimetry, Automation, Polarographic analysis, Electrodes, Water temperature, Hydrogen ion concentration, Salinity, Turbidity, Waves (Water), Ocean currents, Electric power, Costs, Corrosion, Fouling, Flotsam, Calibrations, Acceptance testing, Oceanography, Buoys, Standards.
Identifiers: Photocells, Television.

This six-volume set of reports was prepared to assist the U.S. Coast Guard in maximizing the commonality of hardware and equipment used on various data-gathering platforms (manned, buoy, fixed). Volumes I and II are a discussion and catalog which cover specifications of sensors for measuring optical parameters, ambient noise, conductivity and salinity, currents, depth, dissolved solids, oxygen, pH, sound velocity, waves and tides, and temperature. Considerations of signal conditioning and encoding, power supplies, and equipment costs are also included. (Little-Battelle)
W72-03287

DETERMINATION OF UREA IN BLOOD AND URINE WITH A UREA-SENSITIVE ELECTRODE,
Louisiana State Univ., New Orleans. Dept. of Chemistry.
G. G. Guilbault, and E. Hrabankova.
Analytica Chimica Acta, Vol 52, No 2, p 287-294, November 1970. 8 fig. 3 tab. 14 ref.

Descriptors: *Ureas, *Urine, *Electrodes, *Analytical techniques, Ammonium, Bioassay, Sodium, Potassium, Hydrogen ion concentration. Identifiers: *Chemical interference, *Blood, Biological samples.

The results of a study of the influence of ionic interferences in the determination of urea are summarized and a method for the determination of urea in blood and urine is presented. The urea electrode determines the concentration of urea by sensing the activity of ammonium ions in the enzyme layer produced by the urease-catalyzed

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Group 5A—Identification of Pollutants

hydrolysis of urea. For the determination of urea in biological samples containing urea and diverse ion contaminants, it is necessary to consider that the sensing element of the urea electrode is a Beckman cation electrode that is sensitive not only to ammonium ions formed by the enzymic reaction, but also to Na plus, K plus, NH₄ plus, and H plus ions in the solution. To elucidate the effect of increasing concentrations of these ions on the electrode response, the steady state potential was measured in synthetic mixtures of urea and increasing concentrations of sodium (I) or potassium (I), respectively. An ion-exchange resin Dowex 50W-X2 was used to eliminate these interferences. A precision and accuracy of about 2-3 percent is obtained. (Mortland-Battelle)
W72-03288

FALLOUT PROGRAM - QUARTERLY SUMMARY REPORT SEPTEMBER 1 - DECEMBER 1, 1970 AND APPENDIX.
Atomic Energy Commission, New York. Health and Safety Lab.
Edward P. Hardy, Jr.
Available from the National Technical Information Service as HASL-239 and HASL-239 (Appendix). \$3.00 in paper copy, \$0.95 in microfiche. Report HASL-239 and HASL-239 (Appendix), Jan 1, 1971. 688 p. (approximately).

Descriptors: *Fallout, *Atlantic Ocean, *Strontium, *Environmental effects, *Population, *Human diseases, *Water pollution, Water pollution sources, Radioisotopes, Diets, Food.
Identifiers: Concentration, Radiobiology, Bone, Man, Stratosphere, Drinking water, Dietary habit.

This report presents current data from the HASL Fallout Program, the Institute of Radiation Hygiene in Prague, Czechoslovakia, New York University, The National Radiation Laboratory in New Zealand, the Radiological Physics Division at Argonne National Laboratory, and the EURATOM Joint Nuclear Research Centre at Ispra, Italy. The initial section consists of interpretive reports and notes covering the following topics: strontium-90 in human bone from Czechoslovakia in 1964-1967, strontium-90 fallout over the Atlantic Ocean, Sr-90 fallout at Rocky Flats, Colorado, and comparison of observed and calculated radionuclide levels in the stratosphere. Subsequent sections include tabulations of radionuclide levels in surface air, fallout, milk, other diet components, and tap water. A bibliography of recent publications related to radionuclide studies is also presented. Tables of conversion factors and the half-life of radioisotopes used in the report are also included in tabular form. (Houser-ORNL)
W72-03307

ENVIRONMENTAL RADIATION LEVELS AND CONCENTRATIONS, SECOND HALF AND ANNUAL SUMMARIES, 1970.
Goodyear Atomic Corp., Piketon, Ohio.
B. Kalmon, and S. H. Hulet.
Available from the National Technical Information Service as GAT-629. \$3.00 per copy, \$0.95 microfiche. Report GAT-629, April 1971. 14 p.

Descriptors: *Aquatic environment, *Monitoring, *Control, *Measurements, *Data collections, *Sampling, Isotopes, Water analysis, Hydrologic data, Effluents, Waste water (Pollution), Water pollution sources, Air environment, Fallout, Air pollution.
Identifiers: Concentration, Gaseous diffusion plant.

The average environmental radiation levels for the Goodyear Atomic Corporation gaseous diffusion plant, for the second half of 1970 and for the calendar year 1970, are summarized in this report which is prepared in accordance with the policy of the Atomic Energy Commission. The results for the first half of 1970 have been previously reported in GAT-628 but are also included in tabulated form in

this annual summary. For the second half of 1970, the water alpha, water beta-gamma, air alpha, and the penetrating background dose rates increased when compared with the first half values. The air beta-gamma value decreased when compared to the first half value. In comparing values for calendar year 1970 with calendar year 1969, the water alpha and air alpha decreased in 1970 while the water beta-gamma and air beta-gamma increased. The penetrating background dose rates remained unchanged. An extensive sampling program of air, water and background was carried on and detail results of analysis and concentrations are given. (Houser-ORNL)
W72-03309

UNDERGROUND LEACHING OF URANIUM ORES.
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
For primary bibliographic entry see Field 02K.
W72-03326

ENVIRONMENTAL SAMPLING PROGRAM FOLLOWING AN ACCIDENTAL TRITIUM RELEASE.
California Univ., Livermore. Lawrence Radiation Lab.
J. F. Tinney, D. S. Myers, P. H. Gudiksen, and R. E. Yoder.
Available from the National Technical Information Service as UCRL-51029. \$3.00 per copy, \$0.95 microfiche. Report UCRL-51029, March 12, 1971. 18 p.

Descriptors: *Accidents, *Radioactivity, *Tritium, *Environmental effects, *Monitoring, *Sampling, Air pollution, Water pollution, Water pollution sources, Effluents, Meteorological data, Analytical technique, Food chains.
Identifiers: Concentration, Emergency, Smoke stack.

On August 6, 1970, 289,000 Ci of tritium gas was accidentally released through an exhaust stack at the Lawrence Radiation Laboratory in Livermore, California. Soon after the release emergency-response personnel surveyed the site with portable tritium air monitors and an extensive environmental sampling program was initiated. The results from this sampling program indicate that no significant exposure to on- or off-site individuals resulted from the release. All environmental samples of water, milk, and urine contained normal background levels of tritium. Although detectable levels of activity were found in some vegetation and atmospheric water vapor samples, the highest measured concentrations as well as the calculated maximum credible ground level air concentrations during cloud passage were well below the off-site maximum permissible concentrations for continuous exposure. Since tritium was not present in urine samples above detectable levels, the maximum undetectable dose that could have been received from exposure to the cloud would have been about 0.025 mrem. Based on vegetation sampling results, the maximum dose to a child exposed via the forage-cow-milk pathway would be about 70 mrem. Detail is given for the sequence of events, meteorological predictions and the environmental measurements. (Houser-ORNL)
W72-03328

METHODS AND INSTRUMENTATION IN THE USSR FOR DETERMINATION OF ENVIRONMENTAL RADIOACTIVITY (IN RUSSIAN).
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow. Soyuznyi Nauchno-Issledovatel'skii Institut Probors-troeniya.
L. V. Artemenkov.
Available from UNIPUB, Inc., P.O. Box 433, New York, N.Y. 10016. Nuclear Techniques in Environmental Pollution, International Atomic Energy Agency, Vienna; p 95-107, 1971. 5 fig, 33 ref (STI/PUB-268; CONF-701023).

Descriptors: *Instrumentation, *Monitoring, *Radioactivity, Radioactivity techniques, On-site investigations, Nuclear wastes, Foreign research, Reviews, Water pollution sources, Air pollution, Fallout, Sampling, Analytical techniques, Data processing, Public health.

This review of developments and usage in the USSR considers: (1) wide application of advanced sampling methods, advanced instruments, and automatic systems for measurement and data processing; (2) concurrent development of methods and apparatus for simple measurements under field conditions; (3) specialized instrumentation for continuous monitoring of effluents discharged to the environment; (4) instrument development for monitoring accidental releases; (5) establishment of instrument pools; (6) standardization of instruments suitable for a wide range of applications. Continued research is required in the interest of the public welfare to safeguard water supplies and to prevent contamination of the soil and the atmosphere. (Bopp-ORNL)
W72-03333

PROGRESS REPORT (NO. 15), JAN.-JUNE 1970.
Institute of Nuclear Sciences, Lower Hutt (New Zealand).

Available from the National Technical Information Service as INS-458. \$3.00 in paper copy, \$0.95 in microfiche. Report INS-458, 1970. 80 p, 3 tab, 38 ref.

Descriptors: *Fallout, *Tritium, *Carbon radioisotopes, Antarctic, Pacific Ocean, Radioactivity techniques, Monitoring, Radioactive dating, Radiochemical analysis, Potassium radioisotopes, Geochemistry, Geophysics, Strontium radioisotopes, Radioisotopes.
Identifiers: Cesium radioisotopes, New Zealand.

Research is reported on nuclear physics, radiation chemistry, isotope geochemistry, radioactive dating and radioactive fallout, instrumentation, and isotope applications. Routine tritium analyses were continued of natural waters of New Zealand, the South Pacific, and Antarctica. Water was converted to hydrogen for tritium analysis by a mixture of granulated Zn and sand at 450C, but tests of an electrolytic procedure continued. C-14 in Makara sea water for the first 6 months of 1970 (delta values of 1.3, 19, -52, -23, 24 and 8%) contrasted with the large negative fluctuations for the last 6 months of 1969. Concentrations of fallout radionuclides were determined in rainwater (Cs-137, 0.6-2.5 pCi/liter; Sr-90, 0.5-2; Ba-147, 3-12; Ce-144, 5-19; Y-91, 9; Pr-143, 17; Ba-140, 18; Nd-147, 7) and in coastal water (Cs-137, 0.01-0.08; Sr-90, 0.04-0.13; Pm-147, 0.01-0.08; Ce-144, 0.03-0.21; Y-91, 0.005-0.014). With K-Ar age determinations, an ion exchange separation was used for K analysis. (Bopp-ORNL)
W72-03346

RADIOISOTOPE BIBLIOGRAPHY.
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

Available from the National Technical Information Service as BNWL-1621. \$3.00 in paper copy, \$0.95 in microfiche. Reports and Publications of General Electric Company - Hanford Atomic Products Operations (1960-1964) and Battelle Northwest (1965-mid, 1971), September 1971. 110 p.

Descriptors: *Radioisotopes, *Bibliographies, *Water pollution sources, Water pollution effects, Radioactivity effects, Radioactivity techniques, On-site investigations, Nuclear wastes, Waste treatment, Waste storage, Waste disposal, Public health, Computer programs, Instrumentation, Biology, Ecology, Safety, Meteorology, Aerosols.

The entries are divided into broad subject areas, indexed by author, and indexed by radioisotope.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

Categories and number of references are: Ecology (79), Monitoring (29), Radiobiology (155), Biology-Related Technology (14), Summary Reports in Biology (16), Analytical Chemistry (84), Chemistry Buildings and Facilities (21), Decontamination (10), Inorganic and Physical Chemistry (29), Separation and Purification Technology (126), Waste Storage and Processing (128), Chemistry Summary Reports (50), Computer Applications (18), Earth Sciences (18), Meteorology (33), Health and Safety (85), Radioactive Aerosols (46), Safety-Related Technology (14), Summary Reports in Safety (40), Instrumentation (17), Radiation Detection and Dosimetry (90), Isotope Shielding Calculations (33), Isotope Production (67), Isotope Properties (68), Summary Reports in Isotopes (31), Isotope Source Preparation (40), Materials (45), Miscellaneous (7). (Bopp-ORNL) W72-03350

MONITORING REACTOR EFFLUENTS FOR TRITIUM: PROBLEMS AND POSSIBILITIES, Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs. R. V. Osborne.

Available from the National Technical Information Service as AECL-4054, \$3.00 in paper copy, \$0.95 in microfiche. Paper presented at the Tritium Symposium, Las Vegas, Nevada, August 30-September 2, 1971. 31 p, 10 fig, 2 tab, 23 ref.

Descriptors: *Monitoring, *Nuclear wastes, *Effluents, *Tritium, Instrumentation, Reviews, Radioactivity techniques, On-site investigations, Air pollution, Water pollution control.

Adequate sensitivity, appropriate response time and the ability to operate continuously under industrial conditions are general requirements for all power reactor monitoring systems. Insensitivity to gamma radiation, fission products, activation products, humidity, dirt and luminescent materials is also needed. For monitoring water effluents, a plastic scintillator is sensitive to 1 nCi/cc with about one minute response time. For air, the plastic scintillator has the advantages of easier discrimination to eliminate interference from noble gases, and of higher sensitivity (less than 1 pCi/cc); but ionization methods have the advantage of simplicity. Condensation, exchange with water or collection in liquid scintillator enable monitoring of less than 0.1 pCi/cc in air with response times of several minutes to hours. Choice of system depends upon the needed sensitivity and response time, likely contaminants and running costs. (Bopp-ORNL) W72-03351

MERCURY IN FISH AND WATER FROM A RIVER AND A FJORD IN THE KRAGERO REGION, SOUTH NORWAY, Norges Veterinarhøgskole, Oslo. Bjarne Underdal, and Tore Hastein. Oikos. 22 (1): 101-105. Illus. Maps. 1971. Identifiers: Fish, Fjord, Kragero, Mercury, Norway, River, South.

From a river in South Norway the Hg concentration in samples of water and of fish of the families Salmonidae and Percidae was determined by activation analysis. From the fjord into which the river runs, Gadidae species were analyzed. The mean Hg concentration in water was 0.5 ng/g. In Salmonidae, Percidae and Gadidae species the mean concentration was 1.26 plus or minus 1.88 mg/kg, 1.13 plus or minus 1.83 mg/kg and 0.91 plus or minus 0.65 mg/kg. Downstream a wood pulp factory the corresponding values were 3.58 plus or minus 1.19 and 4.93 plus or minus 1.02 mg/kg respectively for Salmonidae and Percidae. (Copyright 1971, Biological Abstracts, Inc. W72-03411)

EXPERIMENTAL STUDIES ON ELIMINATION OF ZINC-65, CESIUM-137 AND CERIUM-144 BY EUPHAUSIIDS,

South Carolina Univ., Columbia. Baruch Inst. of Estuarine and Littoral Science. S. W. Fowler, L. F. Small, and J. M. Dean. Mar Biol (Berlin). 8 (3): 224-231. Illus. 1971. Identifiers: Artemia, Cerium-144, Cesium-137, Elimination, Euphausia-Pacifica, Euphausiids, Exchange, Isotopic, Molt, Temperature, Zinc-65.

The elimination of 3 radionuclides from Euphausia pacifica was measured over a 5 mo. period. The biological half-lives for ^{65}Zn , ^{137}Cs , and ^{144}Ce , calculated after the euphausiids had ingested radioactive Artemia nauplii, were found to be 140 days, 6 days, and 7.5 hr, respectively. The percentage of body burdens lost in molts were greatest for the fission products, ^{144}Ce (21%) and ^{137}Cs (7%), and least for ^{65}Zn (1%). Elimination of the isotopes in the feces could not be followed because of the difficulty in collecting fecal material for analysis; however, 1 sample collected 2 mo. after the beginning of the elimination experiment had no measurable radioactivity. Loss of ^{65}Zn from molts and time to disintegration of the molts were found to be temperature dependent over a 5 to 15°C range, and the sinking rate of molts was both temperature and salinity dependent. Calculations showed that, in areas in the North Pacific outside the influence of upwelling, percentage ^{65}Zn loss from sinking molts (before disintegration of the molts) was likely to be the same throughout the year, since the molts would be exposed to about the same mean temperature in the water column in all seasons. Even though temperature structure in the upper layers changes with season, mean temperatures change very little when calculated over the sinking distance of intact molts. Intact molts would sink to slightly over 400 m in the absence of turbulence, and would lose 87% of their ^{65}Zn by the time they reached this depth. Sinking molts thus might contribute substantially to the vertical transport of ^{65}Zn in the sea. If loss of ^{65}Zn in fecal pellets is assumed to be small under our experimental conditions, and molting loss is only 1% of ^{65}Zn body burden, the major mechanism of ^{65}Zn loss from euphausiids feeding on non-radioactive food must be isotopic exchange from the water. Approximately 96% of the initial body burden was eliminated over a period of 5 mo. (Copyright 1971, Biological Abstracts, Inc. W72-03423)

ZINC IN THE WEST-BOHEMIA WATERS, Vyzkumny Ustav pro Fysiologii, Balneologii a Klimatologii, Marienbad (Czechoslovakia). M. Sadikova. Identifiers: Bohemia, Drinking, Human, Low, Therapy, Zinc.

The occurrence of Zn in mineral water was examined in regard to its essential character and role in human organism. A specific method for the determination of trace amounts of Zn in water of different chemical composition was elaborated and using for the analysis of waters of the West Bohemia Baths. The mineral waters of Mariánské Lázně and Karlovy Vary contain 20-70 microgram Zn^{2+}/l . Compared with the content of Zn in ordinary drinking water and particularly in food, this amount is very low. Therapy by drinking these mineral waters cannot be a source of Zn even if its better utilization from such water is assumed. (Copyright 1971, Biological Abstracts, Inc. W72-03425)

DERMATOPHYTES AND OTHER KERATINOLYTIC FUNGI IN SURFACE AND WASTE WATERS, Palacky Univ., Olomouc (Czechoslovakia). Faculty of Medicine. M. Simordova, and M. Hejtmánek. Mykosen. 13 (9): 467-471. 1970. Russian and English summaries.

Identifiers: Anixiopsis-Sp, Chrysosporium-Sp, Ctenomyces-Serratus, Dermatophytes, Drinking, Fungi, Keratinolytic, Keratinomyces-Ajelloi, Microsporum-Gypseum, Surface, Trichophyton-Terrestre, Waste.

The presence of dermatophytes and other keratinophilic fungi was proven in 25 of 50 examined water samples. In 32 samples taken from surface watercourses and drinking water reservoirs, 14 samples were contaminated. Anixiopsis sp. (6 times), Keratinomyces ajelloi (5 times), Chrysosporium sp. (4 times), Trichophyton terrestre (twice) and Ctenomyces serratus (once) were found. From 18 waste-water samples, 11 samples were contaminated. Chrysosporium sp. appeared most frequently (10 times). Anixiopsis sp. was present in 4 samples, T. terrestre in 1 sample and also Microsporum gypseum in 1 sample. Microsporum gypseum was identified from waste-water which had passed through the sewage disposal plant. (Copyright 1971, Biological Abstracts, Inc. W72-03435)

PHOTOMETRIC DETECTION OF ZINC AND LEAD IN WATER USING SULFARSAZENE, M. A. Yagodinitsyn. Gig Sanit. 35 (11): 62-63. 1970.

Identifiers: Detection, Lead, Photometric, Sulfarsazene, Zinc.

Detection of 0.005 mg Zn and 0.01 mg Pb in 1-liter water samples is accomplished photometrically at 500 nm with a relative error of not more than 8 and 12%, respectively. Sample preparation, which incorporates sulfarsazene reagent (4'-nitrobenzene-1', 4-diazamino-1,4'-azobenzene-2'-arsono-1'-thioacid) as a complexing colorant, is described. (Copyright 1971, Biological Abstracts, Inc. W72-03440)

DETERMINATION OF NITRATE ION IN MARINE BIOTOPES WITH HIGH NITRATE CONTENT BY ULTRAVIOLET SPECTROPHOTOMETRY, Brussels Univ. (Belgium). Farm Inst. J. Mertens, and D. L. Massart. Soc Chim Belg. 80 (1/2): 151-158. Illus. 1971. Identifiers: Biotopes, Determination, High, Ion, Marine, Nitrate, Spectrophotometry, UV.

A simple and rapid method for the determination of nitrate in seawater of high nitrate content (>1 ppm) is proposed. The absorption of the nitrate ion is measured at 210 and 220 millimicron. The sample is treated with a measured quantity of hydrochloric acid to eliminate the carbonate and bicarbonate interferences and measured against a nitrate free blank prepared by reduction of the nitrate to ammonia with Raney nickel. The addition of HCl permits also storage of the sample without special precautions and the use of the blank eliminates the most serious of the interferences (bromide) expected in seawater. The interference of organic matter limits however the applicability of the method to concentrations higher than 1 ppm. (Copyright 1971, Biological Abstracts, Inc. W72-03495)

IMPROVED INCUBATION AND GAS SAMPLING TECHNIQUE FOR NITROGEN FIXATION STUDIES, Alaska Univ., College. Inst. of Marine Science. Donald M. Schell, and Vera Alexander. Limnol Oceanogr. 15 (6): 961-962. 1970. Identifiers: Acetylene, Fixation, Gas, Incubation, Macrophytes, Nitrogen, Reduction, Sampling, Technique, Vacutainers.

Vacutainers, pre-evacuated glass tubes with heavy septa, into which gas is introduced through a double-ended needle, are used to collect and store gas samples for determining acetylene-reduction N fixation. Incubation vessels consisting of heavy

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

plastic bags secured to collared glass tubes fitted with septa have proved useful for determining N fixation by macrophytes.—Copyright 1971, Biological Abstracts, Inc.
W72-03502

5B. Sources of Pollution

DEPTH TO BASE OF POTABLE WATER IN THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07C.
W72-02953

A STUDY OF HERBICIDE EFFICIENCY TO RICE GROWN IN THE DANUBE FLOOD-PLAIN,
Institutul Agronomic, Bucharest (Rumania).
I. Badea, N. Nicolaescu, and C. Pana.
Lucrari Stiint Inst Agron N Balcescu Sera. 12: 181-190. 1969. English, French, and Russian summaries.
Identifiers: Bristle, Danube, Echinochloa-M, Floodplain, Grass-M, Grown, *Herbicide, Oram, Rice-M, Romania, Sedges-M, Stam-F, Weedar.

Stam-F 34, Oram and Weedar-special were tested in the rice field of the Oltenita State Farm in 1965, 1966 and 1967. Echinochloa, which constituted 80% of the weed population, was sensitive at the 2-4 leaf stage to rates of 12-14 kg/ha of Stam-F 34. The most efficient way of applying the Oram was to plow it under and then the rice seed and flood the field. Rates of 6 l/ha of Oram killed 80-90% of the bristle grass. For Cyperaceae control, the most efficient herbicide was Weedar in rates of 3 l/ha at the beginning of rice tillering.—Copyright 1971, Biological Abstracts, Inc.
W72-03013

EXPERIMENTAL RESEARCH WITH ATRAZINE APPLIED TO THE CORN GROWN IN THE DANUBE FLOODPLAIN,
Institutul Agronomic, Bucharest (Rumania).
I. Badea.
Lucrari Stiint Inst Agron N Balcescu Sera. 12: 173-180. 1969. English, French, and Russian summaries.
Identifiers: Amaranthus-Retroflexus-D, Applied, Atrazine, Convolvulus-Arvensis-D, Corn-M, Cynodon-Dactylon-M, Danube, Echinochloa-Crus-Galli-M, Floodplain, Grown, Phragmites-Communis-M, Polygonum-Hydropiper-D, Romania, Scirpus-M, Setaria-M, Sorghum-Halepense-M, Susceptibility.

The trial involved various rates of atrazine either along with the mechanical cultivation of the soil or alone. Band application of 4-6 kg/ha of atrazine along with the mechanical cultivation of the soil was most efficient in killing weeds. Atrazine was successful for controlling such species of weeds as Setaria, Echinochloa crus-galli, Polygonum hydropiper, Convolvulus arvensis, and Amaranthus retroflexus. Phragmites communis, Cynodon dactylon, Sorghum halepense and Scirpus, widespread, particularly on lands with shallow table water were resistant to atrazine.—Copyright 1971, Biological Abstracts, Inc.
W72-03014

THE SHARE OF AGRICULTURE ON WATER POLLUTION: TAKING POSITION TO THE MANSHOLT PLAN,
Alwin Seifert.
Staedtehygiene. 21 (6): 135-136. 1970.

Descriptors: *Water pollution sources.
Identifiers: Agriculture, Erosion, Fertilizer, Germany, Humus, Mansholt, Nitrate, Plan, Pollution, Share.

Merchanization and large-scale agricultural enterprises have increased the yield per ha by 50%

through use of fertilizers and poisons. The increase in productivity everywhere is paid for by a decrease in the quantity of humus. While virgin soils contain 3 1/2% humus, German worked-over soil contains only 1 1/2%. Decreased humus content means increased wind and water erosion of soil. Countries like the USSR lose yearly, through large scale agriculture, great amounts of chernozem. Large scale agriculture removes trees which act as protection against wind erosion. Agriculture contributes to water pollution (through the use of chemicals) just as industry does through emission and waste. Drinking water is being poisoned by too high a nitrate content from fertilizers. The revival of small scale agriculture is seen as the only relief to this situation.—Copyright 1971, Biological Abstracts, Inc.
W72-03033

DDT AND TOXAPHENE MOVEMENT IN SURFACE WATER FROM COTTON PLOTS,
North Carolina State Univ., Raleigh. Water Resources Research Inst.
J. R. Bradley, Jr., T. J. Sheets, and M. D. Jackson.
Journal of Environmental Quality, Vol 1, No 1, p 102-105, January-March 1972. 1 fig, 3 tab, 15 ref.
UNC-WRII Report No. 19. OWRR-A-040-NC (1).

Descriptors: *Runoff, *Sediment, *Pesticide movement, *Pesticide pollution, *Water pollution sources, Chlorinated hydrocarbon pesticides, Pesticide residues, Path of pollutants, Farm wastes, North Carolina.

When 13.4 kg/ha of DDT were applied to cotton (*Gossypium hirsutum* L.) during the 1969 growing season, 2.83% was found in natural runoff between July 11, 1969 and January 5, 1970. About 96% of the DDT in runoff was associated with suspended sediment. Of 26.8 kg/ha of toxaphene applied, 0.36% was detected in runoff, and 75% of the toxaphene in runoff was in the sediment fraction. When DDT and toxaphene were applied to the same plot (13.4 and 26.8 kg/ha, respectively, over the season) only 1.03% of the DDT was found in runoff, and the percentage for toxaphene was 0.61. A much greater percentage of DDT and toxaphene remained as soil residues than was found in runoff, but a high percentage of the pesticides applied was not recovered. Residues of DDT in water from a small pond within one experimental watershed ranged from <0.35 ppb before spraying to 13.4 ppb during the spraying season. Toxaphene residues in pond water varied from <1 ppb before spraying to 65 ppb about midseason.
W72-03059

ADSORPTION OF CHLORINATED HYDROCARBON PESTICIDES BY MICROBIAL FLOC AND LAKE SEDIMENT AND ITS ECOLOGICAL IMPLICATIONS,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
For primary bibliographic entry see Field 02H.
W72-03115

METAL ION CONTENT OF NIAGARA RIVER WATER,
State University Coll. Buffalo, N.Y. Dept. of Chemistry.
For primary bibliographic entry see Field 02H.
W72-03116

A STUDY OF THE HEAT LOSS OF THE ST. LAWRENCE RIVER BETWEEN KINGSTON AND CORNWALL,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02H.
W72-03128

DISPOSAL OF MERCURY WASTES FROM WATER LABORATORIES,
Environmental Protection Agency, Cincinnati, Ohio.

R. B. Dean, R. T. Williams, and R. H. Wise.
Environmental Science and Technology, Vol. 5, No. 10, p 1044-1045, October 1971, 1 tab.

Descriptors: *Chemical wastes, *Heavy metals, *Waste disposal, Chemical precipitation, Toxins, Ultimate disposal, Waste storage, *Mercury, Water analysis.
Identifiers: *Mercury salts, *Mercury metal, *Laboratory wastes, Organomercurials, Toxic wastes, Metals recovery, Metals disposal.

Procedures for the ecologically satisfactory recovery or disposal of mercury-containing wastes, generated at water laboratories and other laboratories, are described. Suggestions for the prevention of potentially hazardous conditions in the laboratory are also presented.
W72-03149

THE DILUTION OF AN UNDERSEA SEWAGE CLOUD BY SALT FINGERS,
California Univ., Berkeley. Dept. of Civil Engineering.
H. B. Fischer.
Water Research, Vol 5, No 10, p 909-915, October 1971. 3 fig, 13 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Sewage disposal, *Oceans, *Diffusion, Laboratory tests, Analytical techniques, Salinity, Water temperature, Currents (Water), Water circulation, Mixing, Thermocline, Littoral drift, Interfaces.
Identifiers: *Undersea sewage cloud.

A qualitative experiment is described showing that when sewage effluent is released from an undersea diffuser to form a submerged cloud, salt fingers will form at the interface between the top of the cloud and the ocean water above. Calculations based on laboratory experiments show that in a typical practical example the flux through the interface due to the fingers may cause substantial dilution to an effluent cloud during the time that it drifts from the site of the diffuser towards the coast. (Woodard-USGS)
W72-03170

A FLOAT DIFFUSION STUDY,
Chalmers Univ. of Technology, Goteborg (Sweden). Hydraulics Div.; and California Inst. of Tech. Pasadena.
K. Cederwall.
Water Research, Vol 5, No 10, p 889-907, October 1971. 9 fig, 4 tab, 12 ref. FWQA Grant No 16070 DGY.

Descriptors: *Diffusion, *Aquatic drift, *Path of pollutants, *Floats, Laboratory tests, Analytical techniques, Flumes, Water circulation, Currents (Water), Mathematical studies.
Identifiers: Lateral diffusion.

Float diffusion experiments were conducted in a laboratory flume. It was found that the lateral diffusivity decreased with increasing float size for a given flow situation. A similar trend was found when studying the response of the floats to vorticity. Hence, it is reasonable to conclude that for larger particles the turbulent fluctuations of scales smaller than the sizes of the particles themselves have little or no effect on the movements of the particles. Considering the particle and fluid inertia relations a kinematical approach for describing particle diffusion would be at least qualitatively appropriate. The float diffusion experiments agreed with an earlier model when the largest eddies of the turbulence spectrum were assumed to be about four times the depth of the flow. (Woodard-USGS)
W72-03172

INVESTIGATION OF THE USE OF CHLORIDE FROM PRECIPITATION AS A GROUND WATER TRACER,
Montana Univ., Bozeman. Joint Water Resources Research Center.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

For primary bibliographic entry see Field 02F.
W72-03187

DEVELOPMENT OF A SIMULATION MODEL FOR STORMWATER MANAGEMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 06A.
W72-03198

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05G.
W72-03234

THE COMPONENTS OF OXYGENATION IN FLOWING STREAMS,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05G.
W72-03235

IRON-59 AS A SOLIDS TRACER IN AQUEOUS SUSPENSIONS,
Robert S. Kerr Research Center, Ada, Okla.
M. R. Scaif, J. L. Witherow, and C. P. Priesing.
Available from the National Technical Information Service as PB-205 827, \$3.00 in paper copy, \$0.95 in microfiche. Robert S. Kerr Water Research Center Report, Federal Water Pollution Control Administration, October 1967. 32 p, 8 fig, 2 tab, 15 ref, 2 append. FWPCA Project 16020—10/67 PB-205 827.

Descriptors: *Water pollution sources, *Pollutant identification, *Tracking techniques, *Tracers, *Path of pollutants, Analytical techniques, Silting, Sewage, Sludge, Solid wastes, Silts, Suspended load.
Identifiers: *Iron-59 (Solids tracer), Aqueous suspensions.

Tracer methods using iron-59 were devised for silt tracing in rivers and reservoirs, suspension tracing in lagoons, and sludge handling processes. Iron-59 almost completely adheres to particulate matter when introduced into a sewage suspension. When using iron-59 as a tracer in systems which recirculate solids, an excessive tailing effect may be expected on the dispersion curve unless the recirculated radioactivity is measured and subtracted. Iron-59 has two hard gammas, one at 1.098 Mev and another at 1.289 Mev. In addition, it has two strong betas which allow the beta counting of samples collected. Iron-59 has a half life of 45.1 days which is sufficient time for preparation, experimentation, and later analyses of samples at the laboratory. (Woodard-USGS)
W72-03236

FALLOUT PROGRAM - QUARTERLY SUMMARY REPORT SEPTEMBER 1 - DECEMBER 1, 1970 AND APPENDIX,
Atomic Energy Commission, New York. health and Safety Lab.
For primary bibliographic entry see Field 05A.
W72-03307

IMPORTANCE OF TRITIUM IN THE CIVIL DEFENSE CONTEXT,
Lawrence Radiation Lab. California Univ., Livermore.
J. R. Martin, and J. J. Koranda.
Available from the National Technical Information Service as UCRL-73085, \$3.00 per copy, \$0.95 microfiche. Report UCRL-73085, March 8, 1971. 15 p.

Descriptors: *Civil Defense, *Tritium, *Fallout, *Radioactivity effects, Damages, *Equilibrium, Stabilization, Water, Water pollution, Pollutant identification, Water pollution sources, Water quality, Water quality control, Nuclear explosions.

Identifiers: Comparison, Tritiated water, Dose, Fission product, Radiation damage.

The survival of man in an environment contaminated with radioactive fallout after a nuclear attack is the basis upon which the importance of tritium in the civil defense context can be assessed. Although tritium is a weak beta emitter, the radiation hazard to man can be significant because of the high yield of residual tritium from fusion devices. Also, tritium is relatively mobile, and as tritiated water, becomes rapidly dispersed in the environment where it is available for ingestion by man. On the other hand, the hazard is reduced somewhat by the dilution of tritium with the large amount of water in the environment. The importance of tritium in the civil defense context is assessed by comparing the dose rate and 30-year dose integral for tritium from fusion with the external dose of gamma-emitting fission products. The tritium dose is computed by assuming equilibration of fallout tritium with water in the biosphere and with body water of man. The fission product gamma dose for late-time dose significant nuclides are tabulated in terms of R/hr/kt/sq mi as a function of time. Tritium is shown to be relatively unimportant in the civil defense context when compared with the external gamma dose from an equal yield of fission products. (Houser-ORNL)
W72-03308

ENVIRONMENTAL RADIATION LEVELS AND CONCENTRATIONS, SECOND HALF AND ANNUAL SUMMARIES, 1970,
Goodyear Atomic Corp., Piketon, Ohio.
For primary bibliographic entry see Field 05A.
W72-03309

APPLICATIONS OF RADIOISOTOPES AND RADIATION SOURCES IN INDUSTRY, RADIATION PROCESSING AND HYDROLOGY - CURRENT STATUS IN INDIA,
Bhabha Atomic Research Centre, Trombay (India).
For primary bibliographic entry see Field 07B.
W72-03316

METHOD TO DETERMINE THE ABSORBED DOSE OF NATURAL RADIOACTIVITY IN UNDERGROUND WATERS (IN RUSSIAN),
Kiev State Univ. (USSR).
I. F. Vouk.
Available from the National Technical Information Service as DOPU. AKAD. NAUK UKR. RSR, Ser. B 1970, 32 (10), 881-3, \$3.00 per copy, \$0.95 microfiche. DOPU. AKAD. NAUK UKR. RSR, Ser. B, Vol 32, No 10, p 881-3, 1970.

Descriptors: *Radioactivity, *Radioactivity effects, *Measurements, *Absorption, Groundwater, Rocks, Reservoirs, Movement, Circulation, Filtration, Banks, Basins.
Identifiers: Dosimetry, Dose calculation - External, Concentration, Radon, Radium.

A method for calculating the radioactivity absorbed by ground waters is suggested. It is based on the determination of the radioactive element contents in the reservoir rocks in which the waters are moving, the study of filtration parameters of the reservoir rocks, and the determination of radium and radon contents in the water. (Houser-ORNL)
W72-03320

HYDROLOGICAL ISOTOPIC TECHNIQUES FOR THE STUDY OF WATER RESOURCES IN MEXICO,
Universidad Nacional Autonoma de Mexico, Mexico City. Nuclear Lab.; and Comision Nacional de Energia Nuclear, Mexico City.
For primary bibliographic entry see Field 07B.
W72-03329

METHODS AND INSTRUMENTATION IN THE USSR FOR DETERMINATION OF ENVIRONMENTAL RADIOACTIVITY (IN RUSSIAN),
Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Soyuznyi Nauchno-Issledovatel'skii Institut Proborostroeniya.
For primary bibliographic entry see Field 05A.
W72-03333

SELECTED ENVIRONMENTAL STUDIES USING RADIOACTIVE ISOTOPES,
Atomic Energy Research Establishment, Harwell (England); and Water Resources Board, Reading (England).
D. B. Smith, and H. J. Richards.
Available from National Technical Information Service as A CONF 49 P-509, \$3.00 in paper copy, \$0.95 in microfiche. Report A CONF 49 P-509, May 1971. 13 p.

Descriptors: *Radioactivity techniques, *Tracers, *Groundwater movement, *Stream-aquifer relationships, Groundwater recharge, Fallout, Tritium, Sediment transport, Silting, Coasts, Water pollution sources, Foreign research, On-site investigations.

Water movement in unsaturated strata was traced by tritium infiltration from thermonuclear testing (sometimes in conjunction with the injection of additional tritium). The rate of recharge of aquifers was determined similarly. Tracers for coastal siltation were studied: sodium in natural silt which was made radioactive by irradiation with thermal neutrons, Sc-46 adsorbed on the silt, and a glass containing 2.4% Sc-46 which was added as the oxide. The glass was used in various particle size distributions. (Bopp-ORNL)
W72-03336

VARIATIONS OF MN-54, CO-60, ZN-65, AG-110M, AND AG-108M OBSERVED IN TUNAS,
Scripps Institution of Oceanography, La Jolla, Calif.

T. R. Folsom, D. R. Young, V. F. Hodge, and R. Grismore.
Available from the National Technical Information Service as CONF. 710501-33, \$3.00 in paper copy, \$0.95 in microfiche. Report CONF-710501-33, May 1971. 26 p, 3 fig, 7 tab, 17 ref.

Descriptors: *Fish, *Radioisotopes, *Fallout, Columbia River, Nuclear powerplants, Nuclear wastes, Pacific Coast Region, Zinc radioisotopes, Stratified flow, Cobalt radioisotopes, Oceanography, Water pollution sources, Path of pollutants.
Identifiers: *Tuna, Cesium radioisotopes, Silver radioisotopes, Manganese radioisotopes.

An oceanographic survey begun about a decade ago has made use of traces of radioactivity in the livers of commercially harvested tunas. Sampling of tunas at widely separated parts of the ocean has shown large increases of fallout Zn-65. Thus the Columbia River is not the only source of Zn-65 in the sea near southern California. How effectively the California Current can disperse coastal nuclear powerplant discharges will depend upon the downward mixing. If stratification persists at shallow depths, as observed in 1967 for fallout Cs-137, transport and uptake by marine organisms may occur over large areas of the Pacific. (Bopp-ORNL)
W72-03339

SOME APPLICATIONS OF RADIOISOTOPES IN COASTAL POLLUTION CONTROL,
Danish Isotope Center, Copenhagen.
J. J. Edens.
Available from the National Technical Information Service as A CONF 49 P-646, \$3.00 in paper copy, \$0.95 in microfiche. Report A/CONF.49/P/646, May 1971. 18 p, 8 fig, 17 ref.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

Descriptors: *Path of pollutants, *Radioactivity techniques, *Waste dilution, *Seashores, Coasts, Bacteria, Water pollution sources, Instrumentation, On-site investigations, Computer programs, Stratified flow, Computer models, Phytoplankton, Carbon radioisotopes.

Identifiers: Bromine radioisotopes, Mercury, Neutron-activation analysis.

Simultaneous measurements of bacteria and tracer were used to measure die away of bacteria, after about 1 Ci of Br-82 (as NH₄Br in 1 liter of water) was injected into 1200 liter/min of sewage discharged 500 meters offshore and 13 meters below the surface in the stratified 'Sound' between Denmark and Sweden. Measurements utilized a scintillation detector lowered from an anchored boat. 'Trapping levels' were somewhat lower than calculated from a theory of stratified flow (J. Hansen, Symposium on the Use of Nuclear Techniques in the Measurement and Control of Environmental Pollution, Oct. 1970). A computer program was written for this theory. (Bopp-ORNL)
W72-03340

SOILS AS COMPONENTS OF ECOSYSTEMS,
Oak Ridge National Lab. Tenn. Ecological Sciences Div.
For primary bibliographic entry see Field 021.
W72-03342

USE OF NUCLEAR TECHNIQUES IN THE MEASUREMENT AND CONTROL OF ENVIRONMENTAL POLLUTION (REPORT ON THE INTERNATIONAL ATOMIC ENERGY AGENCY SYMPOSIUM HELD IN SALZBURG, AUSTRIA, FROM 26 TO 30 OCTOBER 1970),

Atomic Energy Reviews, Vol. 9, No. 1, p 229-236, 1971.

Descriptors: *Path of pollutants, *Water pollution sources, *Neutron activation analysis, *Radioactivity techniques, Tracers, Monitoring, On-site investigations, Air pollution, Estuarine environment, Marine bacteria, Radioisotopes, Reviews, Waste treatment, Ecosystems, Aquatic environment, Thermal pollution, Systems analysis, Sediment transport, Fish, Computers, Instrumentation, Nuclear wastes.

The following areas are discussed: (1) General activation analysis and other radioisotope-based techniques; on-line computer analysis of air, water and soil; modelling of thermal pollution; central-control-panel processing of gamma radiation levels at monitoring points. (2) Air pollution. (3) Water pollution (activation analysis of 17 elements in fish and sediments using ion-exchange separation of Na, P, and K and fitting to tape-recorded spectra; activation analysis of 17 of the 30 elements of principal interest in water chemistry; x-ray fluorescence using a radio-isotope source; identification of oil pollution sources). (4) Mercury and other metallic compounds. (5) Organic pollutants and pesticide residues. (6) Coastal pollution (tracer studies of water and sediment motion; interaction of pollutants with marine ecosystems; disappearance of bacteria compared with physical dilution of sewage). (7) Tracer techniques in ecosystems (systems analysis, automatic analysis, in-vivo counting of organs, concept of specific activity). (8) Sludge and waste-water treatment. (9) Discussion sessions. (Bopp-ORNL)
W72-03344

BIOLOGICAL CYCLING OF ELEMENTS AND STABLE ISOTOPES IN MARINE ENVIRONMENTS,
California Univ., Los Angeles.
I. R. Kaplan, B. J. Priestley, and Arie Nissenbaum. Available from National Technical Information Service as TID-25745, \$3.00 in paper copy, \$0.95 in microfiche. Progress Report January 1, 1970-March 31, 1971, TID-25745, 1971. 61 p, 6 fig, 7 tab, 36 ref. AEC Contract AT (04-3)-34.

Descriptors: *Marine geology, *Sedimentation, *Sulfides, Reduction (Chemical), Sea water, Uranium radioisotopes, Stable isotopes, Trace elements, Fjords, Coral, Reefs, Oxidation-reduction potential, Hydrogen ion concentration, Alkalinity, Phosphates, Sulfates, Degradation (Decomposition), Organic matter, Water chemistry, Heavy metals, Water pollution sources.

It is possible that metals introduced either by volcanic activity or through weathering of rocks may be fixed as sulfides in the sediment of a lagoon (accounting for the association of ore deposits with coral reefs). Present studies included: heavy-metal sulfide formation in sediments, U-234/U-235 dating, capture by sedimentation of transition metals derived from weathering of lateritic soil, U in reducing sediments, transition and base metals in interstitial water and sediments, degradation of organic matter in coastal and Dead Sea sediments, and composition of interstitial water from deep ocean cores. (Bopp-ORNL)
W72-03345

RADIOISOTOPE BIBLIOGRAPHY.
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05A.
W72-03350

GASOLINE IN GROUNDWATER IN LOS ANGELES COUNTY,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 05G.
W72-03353

SEMINAR ON WATER POLLUTION BY OIL,
Ministry of Housing and Local Government, London (England). Directorate of Engineering.
For primary bibliographic entry see Field 05G.
W72-03358

AUTOCHTHONOUS CAESIUM AND BEHAVIOUR OF ALLOCHTHONOUS CAESIUM IN A FISH POND,
Central Lab. for Radiological Protection, Warsaw (Poland).
Stanislaw Wlodek, Maria Bysiek, and Danuta Grzybowska.
Ekol Pol Ser A. 18 (30): 613-623. Illus. 1970. Polish summary.
Identifiers: Allochthonous, Autochthonous, Behavior, Cesium, Fish, Pond.

Time changes in Cs contents polluting the fish pond, its water, bottom sediments and living organisms is reported. The contents of autochthonous Cs in these parts of the pond ecosystem are also reported.—Copyright 1971, Biological Abstracts, Inc.
W72-03372

A STUDY OF SOIL BIOASSAY TECHNIQUE USING PROMETRYNE,
Oklahoma Univ., Stillwater. Dept. of Agronomy.
P. W. Santelmann, J. B. Weber, and A. F. Wiese.
Weed Sci. 19 (2): 170-174. Illus. 1971.
Identifiers: Avena-Sativa-M, Bioassay, Herbicidal, Prometryne, Soil, Technique.

A cooperative study to evaluate the accuracy and precision of bioassays was carried out among investigators at several locations for 3 yr. Oats (Avena sativa L., var. Cimarron) seedlings were used as indicator plants for soil-applied 2,4-bis-(isopropylamino)-6-methylthio-s-triazine (prometryne). Assay results varied a great deal initially, and ranged from 147% below to 234% above the prometryne actually applied. The adoption of uniform conditions and procedures greatly increased the uniformity of the determinations between locations to a range of from 37% low to 0% high in the prometryne applied. Chemical analyses of the soils ranged from 13% low to 20% high. Measurements of herbicidal activity included

dry and fresh plant weights, plant height, visual injury ratings, and plant water use. The average concentration of prometryne in the soil as estimated with several types of measurements gave a much better measure of prometryne content than any one measurement alone. Prometryne rapidly and greatly affected the utilization of water by oats seedlings and careful measurement of water use showed potential of being a good early indicator of prometryne activity.—Copyright 1971, Biological Abstracts, Inc.
W72-03427

ANIONIC DETERGENT AND CHLORINE CONCENTRATIONS IN POLDER DITCHES IN A FORMER MALARIOUS AREA: WALCHERN ISLAND, ZEELAND PROVINCE, THE NETH.,
Institute of Tropical Hygiene, Amsterdam (Netherlands).
For primary bibliographic entry see Field 05C.
W72-03437

5C. Effects of Pollution

THE BENTHIC ECOLOGY OF LOCH LINNHE AND LOCH EIL, A SEA-LOCH SYSTEM ON THE WEST COAST OF SCOTLAND: III. THE EFFECT ON THE BENTHIC FAUNA OF THE INTRODUCTION OF PULP MILL EFFLUENT,
Dunstaffnage Marine Research Lab., Oban (Scotland).
T. H. Pearson.
J Exp Mar Biol Ecol. 6 (3): 211-233. Illus. Map. 1971.

Descriptors: *Industrial wastes, *Amphibia-Chiaiei, Benthic, Coast, Corbula-Gibba, Ecology, Effluent, Eil, Fauna, Linnhe, Loch, Mill, Myrtea-Spinifera, Nucula-Sp, *Pulp, Scotland, Sea, System, West.

A 5 yr survey of the macrobenthic fauna of Lochs Linnhe and Eil on the west coast of Scotland was undertaken to assess the effects on the fauna of the discharge of effluent from a pulp and paper mill into the narrows between the 2 lochs. Effluent discharge began early in 1966, and the survey covered the 2 years prior to this date and the subsequent years. The characteristics of the effluent are described. Variations in the total organic carbon content of the bottom sediments show little change over the period in the C levels at the deep-water stations, but show rises in the amounts at the shallow-water stations adjacent to the effluent outfall. The total biomass of the fauna at 6 regular sampling stations showed increases of between 13 and 62% in the 3-yr post-effluent period when compared with the pre-effluent period; however, the largest increases were recorded 1-2 yr after introduction of effluent and the later samples showed a return to the biomass levels existing during the pre-effluent period. Variations in the numbers of the major molluscan and echinoderm species are analysed. A general increase in the numbers of the molluscs Corbula gibba (Oliv.), Nucula sp. and Myrtea spinifera (Montagu) and the echinoderm Amphibia chiaiei Forbes took place in the period, Sept. 1966 to July 1968, and were followed by a decline in the later months of 1968. C. gibba showed the rise earliest at the station at the head of Loch Eil where it had its highest resident populations, followed successively by rises at the station in mid-loch Linnhe, and in 1968 it extended its range to the station furthest down Loch Linnhe. The feeding ecology of these species is discussed and the possible effect of the effluent on larval and adult stages are considered. It is concluded that, although following introduction of the effluent the successful larval settlement of the species considered may have been enhanced, the fluctuations observed are within the known range of benthic population changes, so that it seems unlikely that the introduction of effluent into the system has yet had any marked positive or negative effect on the benthic populations in the survey area.—Copyright 1971, Biological Abstracts, Inc.
W72-03003

ALGAE ON THE ARTIFICIAL SUBSTRATUM IN THE WIELKI STAW IN THE VALLEY OF THE FIVE POLISH LAKES (HIGH TATRA MOUNTAINS),

Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.

Barbara Kawecka.
Acta Hydrobiol. 12 (4): 423-430. Illus. 1970. Polish summary.

Identifiers: *Algae, Artificial, *Lakes, List, Mountains, Poland, Polish, Staw, Substratum, Tatra, Valley, Wielki.

The algae species which settled on artificial substratum suspended at various depths during 2 seasons in the lake are listed.—Copyright 1971, Biological Abstracts, Inc. W72-03005

FORMATION OF BOTTOM FAUNA IN THE GOCZALKOWICE DAM RESERVOIR,

Polish Academy of Sciences, Psczyna. Hydrobiological Station.

Edward Krzyżanek.
Acta Hydrobiol. 12 (4): 399-421. Illus. Maps. 1970. Polish summary.

Identifiers: Bottom, Chironomus-Plumosus, Cryptochironomus, Dam, *Fauna, Formation, Goczałkowice, Poland, Procladius, *Reservoir.

The formation of bottom fauna in the Goczałkowice reservoir has been observed since 1955. According to published works and to the author's own investigation, there were 3 stages in the formation of bottom fauna. The 1st stage (1955-1957) was characterized by the escape and death of land forms and the appearance of new ones; the 2nd (1953-1961) and last period, showed a general decrease in the number of bottom fauna and an increase in the number of pelophilous forms. In the Chironomidae group some forms disappeared while new ones appeared. There was also an increased development of such forms as Procladius, Chironomus plumosus, and various species of the genus Cryptochironomus.—Copyright 1971, Biological Abstracts, Inc. W72-03006

BOTTOM SEDIMENTS OF THE POLLUTED DAM RESERVOIR AT OTMUCHOW,

Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.

Kazimierz Pasternak.
Acta Hydrobiol. 12 (4): 377-390. Illus. 1970. Polish summary.

Identifiers: Bottom, Chemical, Constituents, Dam, Otmuchow, Poland, Polluted, *Reservoir, *Sediments.

Investigations were carried out on the physico-chemical properties of sediments of the Subudetic dam reservoir, from the point of view of their relation to the kind and actual degree of pollution of the river water (wastes of the cellulose-paper and sugar industries). The material accumulating in the reservoir consists almost exclusively of suspended matter. As a result of the inflow of polluted water for many years, the sediments of the Otmuchow reservoir contain several times more organic matter and mineral P than those of the other Polish dam reservoirs with pure water. The organic matter of the investigated sediments is characterized. Apart from the considerable mass of cellulose fibers resistant to decompositions, it contains an unusually high percentage of free fulvic and humic acids, undergoing dissolution and mineralization. In some zones of the reservoir hydrogen sulfide and phenols were detected in the sediments. Moreover, the sediments are characterized by a very high content of bitumens, a relatively low content of Ca and sulfates, an acid reaction, and an increased Fe content. The paper concludes with consideration on the detrimental effect of this kind of sediment and of the water of the river on the environment and biocenosis of the reservoir.—Copyright 1971, Biological Abstracts, Inc. W72-03007

BIOLOGICAL ASPECTS OF POLLUTION IN THE HEATHCOTE RIVER, CHRISTCHURCH, NEW ZEALAND,

Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.

Jan Cameron.
N Z J Mar Freshwater Res. 4 (4): 431-444. Illus. Map. 1970.

Identifiers: Biological, Christchurch, Fauna, Heathcote, Indicators, Macro, Microorganisms, *New Zealand, *Pollution, River.

The presence and degree of pollution in the Heathcote River was estimated from bacterial and chemical analyses of water sampled at low tide from 5 stations in summer 1967-68. The river is very badly polluted in the industrial area and downstream of it, but is fairly clean upstream of the industrial area. Results of analyses of microorganisms and macrofauna at 20 stations are presented and distributions of these organisms are related to salinity and pollution in the river. Pollution is restricting the macrofauna of the river but is encouraging micro-organism populations. Three groups of macrofauna are present: Those present in clean freshwater only, those tolerating pollution but restricted to freshwater, and those tolerating pollution but restricted to saline water. The use of these groups of species as biological indicators of pollution in the Heathcote River has been evaluated; pollution appears to be indicated by absence of a group of species rather than by presence of 1 spp.—Copyright 1971, Biological Abstracts, Inc. W72-03008

CYCLE OF PHYSICAL-CHEMICAL OBSERVATIONS IN THE LAKE FUSARO,

Messina Univ. (Italy). Istituto di Zoologia.

For primary bibliographic entry see Field 02H. W72-03017

SOME BIOLOGICAL AND HYDROCHEMICAL OBSERVATIONS FROM THE STICHT-ANKEVEENSE POLDER AND MEERHOEK. (PROVINCE OF N-HOLLAND, NETHERLANDS),

Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).

R. Peelen.
Biol. Jaarb. 35: 195-202. Illus. Map. 1967.

Identifiers: Algae, Biological, Holland, Hydrochemical, Meerhoek, Netherlands, North, pH, *Polder, Preservation, Province, Sticht-Ankeveen.

The area surveyed became a moor in the 16th and 17th centuries through which a canal was dug and several ditches, the bottoms of which were covered with algae. The source of water is the Reede Vaart which provides a shortcut between 2 points in the meandering Vecht river. The mineral contents of the polluted polder water are shown for various locations. The changing pH of the polder water is charted for various parts of the year, and the effect of a new pumping station for the area is discussed as contributing to the preservation of the area as a pastoral setting.—Copyright 1971, Biological Abstracts, Inc. W72-03018

IMPACT OF ECOLOGICAL SUCCESSION ON THE PARASITE FAUNA IN CENTRARCHIDS FROM OLIGOTROPHIC AND EUTROPHIC ECOSYSTEMS,

Wake Forest Univ., Winston-Salem, N.C. Dept. of Biology.

Gerald W. Esch.
Amer. Midland Natur. 86 (1): 160-168. 1971.

Identifiers: Birds, Centrarchids, Ecological, Ecosystems, *Eutrophic, Fauna, Gastropods, Impact, Mammals, *Oligotrophic, Parasite, Predator, Prey, Relations, Succession.

Approximately 30 spp. of larval and adult parasites were collected from 549 centrarchid fish and 7718 gastropod molluscs from an oligotrophic and 2 eutrophic lakes in southwestern Michigan. The

distribution pattern indicates that centrarchids from the oligotrophic lake harbor a wide range of species of adult parasites and a comparatively smaller number of larval forms, many of which complete their life cycle in predatory fish. Bass and sunfish from the 2 eutrophic lakes harbor a proportionately larger number of larval parasites, most of which culminate their life cycles in fish-eating birds and mammals. A trophic hypothesis, based on the nature of predator-prey relationships in each of the 2 types of ecosystem, is proposed to explain the distribution patterns of parasites.—Copyright 1971, Biological Abstracts, Inc. W72-03020

SELECTED ALGAE OF DAM RESERVOIRS, THE RIVER SOLA, AND CARP PONDS,

Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.

Lucja Krzeczowska-Woloszyn, Halina, Bucka, and Krystyna Kyselowa.

Acta Hydrobiol. 13 (1): 107-116. Illus. 1971.

Identifiers: Algae, Carp, Chrysococcus, Dam, Kephyrion, Kephyriopsis, Poland, Ponds, Pseudokephyrion, Reservoirs, River, Scenedesmus, Selected, Siderocystis, Sola, Trachelomonas.

Five euglenoid species of the genus Trachelomonas, 12 spp. and 1 variety of chrysophytes of the genera Pseudokephyrion, Kephyrion, Kephyriopsis, and Chrysococcus, and 3 spp. of green algae of the genera Scenedesmus and Siderocystis were determined as being rare or new for Poland. They were found in the plankton of fishponds, in dam reservoirs, and in the Sola River.—Copyright 1971, Biological Abstracts, Inc. W72-03021

A SURVEY OF THE FRESHWATER ALGAE OF UNION COUNTY, ILLINOIS,

Trevetta F. Wunderlin.

Castanea. 36 (1): 1-53. Map. 1971.

Identifiers: *Algae, Annotated, Checklist, County, Fresh, Illinois, New, Records, Survey, Union, USA, Water.

A total of 364 taxa were identified from 115 collection sites. Of these, 149 are new records for the state. The groups represented in the flora are the Chlorophyceae, Charophyceae, Euglenophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae, Dinophyceae, and Cyanophyceae. The best represented orders were the Chlorococcales, Zygnematales and Euglenales. An annotated checklist is included.—Copyright 1971, Biological Abstracts, Inc. W72-03022

THE EFFECT OF PHENOLS IN INLAND WATERS ON THE SANITARY QUALITIES OF FISH MEAT,

L. M. Maslov, and E. F. Vasil'ev.

Nauch. Tr. Omsk. Med. Inst. 95: 24-32. 1969. Translated from Ref. Zh. Otd. Vyp. Farmakol. Khimioter. Sredstva Toksikol. 1970, No. 7.54.821.

Identifiers: Fish, Inland, Meat, *Phenols, Qualities, Sanitary, Sterile.

In different years the content of volatile phenols in the waters of the Irtysh River downstream from the discharge point of the petroleum-processing combine varied from 0.57 to 5.0 mg/liter. Studies were made under aquarium conditions of the effect of phenols on the organoleptic properties of sterlets caught in nonpolluted waters. When the phenol concentration was 0.1 mg/liter, the smell and taste appeared in the sterlets meat on the 7th day; after the sterlets had been transferred to an aquarium with pure water, the phenol smell and taste remained until the 21st day. When the fish were maintained in an aquarium with a phenol concentration of 0.01 mg/liter, the smell and taste appeared on the 8th day; on the 31st day after the sterlets had been transferred to pure water, these phenomena in the sterlet meat disappeared. At a concentration of 0.001 mg/liter, phenol smell and

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taste appeared on the 9th day and disappeared 34 days after transfer to pure water. At the phenols concentrations used in these studies the fish were torpid and of reduced mobility. When the concentration was 0.0001 mg/liter there was no effect on the organoleptic properties of the sterile meat after 50 days.—Copyright 1971, Biological Abstracts, Inc.
W72-03024

CORRELATION OF STRUCTURE VERSUS ACTIVITY OF POLLUTANTS OF FRESH WATER, Rhode Island Univ., Kingston. Water Resources Center.

H. W. Bond, and G. C. Fuller.

Available from the National Technical Information Service as PB-205 606, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Rhode Island Water Resources Center, Kingston, (1971), 11 p, 1 fig, 6 tab, 9 ref. OWRR A-028-R.I. (1)

Descriptors: *Thiol-affinity-sulfhydryl-reactive agents, *Sulfhydryl-thiol affinity-rate assay, *Cysteine-B-nitrostyrene interaction, *Sulfhydryl reactivity, *Oxygen-uptake inhibitions, *Cysteine, *B-nitrostyrenes, *Vinyl sulfones.
Identifiers: *Chemical reactions, Monitoring, Spectrophotometry, *Molluscs, *Snails, *Toxicity.

The toxicity of many classes of compounds in snails (and probably in many other aquatic animals as well) is due to the ability of these compounds to inhibit oxygen uptake, by interaction with enzymes which require intact-SH (i.e. Sulfhydryl) groups for normal function. Among the classes of compounds highly toxic to snails which are potent sulfhydryl inhibitors are B-nitrostyrenes, Vinyl ketones, vinyl sulfones, zinc dithiocarbamates, and quaternary salts. The sulfhydryl reactivity of representative B-nitrostyrenes and vinyl sulfones was determined by observing the change produced by the color-forming reaction between cysteine and 5, 5 (1)-dithiobis (2-nitrobenzoic acid) in the presence and in the absence of the sulfhydryl reactive agent. There is a direct correlation, for the compounds studied between their toxicity to snails and their ability to inhibit sulfhydryl groups. This suggests that similar correlations likely exist for other compounds whose toxicity to snails is due to their ability to inhibit sulfhydryl groups.
W72-03144

STUDIES ON ALGAE FROM EUTROPHIC AND OLIGOTROPHIC WATERS AND THEIR USE IN THE BIO-ASSAY OF WATER QUALITY, Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology. For primary bibliographic entry see Field 05A. W72-03183

LYSOGENY OF A BLUE-GREEN ALGA, PLECTONEMA BORYANUM, Delaware Univ., Newark. Dept. of Biological Sciences.

R. E. Cannon, M. S. Shane, and Valerie N. Bush. Virology, Vol. 45, No. 1, p 149-153, July 1971. 1 fig, 1 tab, 9 ref. OWRR A-016-DEL (1).

Descriptors: *Cyanophyta, Algae, *Viruses.
Identifiers: *Lysogeny, *Plectonema boryanum, LPP-1, LPP-1D, Phycovirus, Mitomycin C.

Evidence for lysogeny of a filamentous blue-green alga, Plectonema boryanum, is presented. A suspected lysogenic strain which carries phycovirus designated LPP-1D (Delaware strain) has been subcultured for four years. Viral neutralization tests show that LPP-1D is antigenically similar to LPP-1. Induction experiments of lysogenic Plectonema with an antibiotic, Mitomycin C, result in 100-fold increase in phycovirus titer 4-5 hr after treatment. Growth of lysogenic cultures with antiphycovirus serum eliminates all free phycovirus in the culture. Ten days later, phycovirus is again present in the medium. LPP-1

appears to be a virulent strain while LPP-1D may be a temperate strain of the same type of phycovirus which has lysogenized Plectonema boryanum.
W72-03188

SAMPLING AND MEASUREMENT IN THE AQUATIC ENVIRONMENT, Washington State Univ., Pullman. Dept. of Sanitary Engineering.

Surinder K. Bhagat, Donald E. Proctor, and William H. Funk.

Presented at the 25th Purdue Industrial Waste Conference, Lafayette, Indiana, May 5-7, 1970, Mimeo (undated), 22 p. 13 fig, 1 tab, 14 ref. 15-12-68 16080 ERO.

Descriptors: *Eutrophication, *Measurement, *Sampling, Water resources, Area redevelopment, Biological characteristics, Algae, Zooplankton, Bacteria, Nutrients, Sediments, Environmental effects, Trace elements, Analytical techniques, Columbia River, Washington, Oregon.
Identifiers: *Vancouver Lake (Wash), Vancouver (Wash), Portland (Ore), Water quality analyzer.

Vancouver Lake (Washington) presently polluted, which has the potential of becoming a useful multipurpose resource, was studied to determine the present water quality conditions, evaluate pollution sources, and explore ways to improve its usefulness. Such sampling and measurements which were considered necessary in attaining Vancouver Lake project objectives are discussed in detail. Measurements were made of biological and bacteriological activities, nutrient levels, and the existing environmental conditions. The most prominent alga is Aphanizomenon flos-aquae, one of the more unsightly and odoriferous. A biological inventory of the bottom organisms showed aquatic earthworms characteristic of shallow and turbid waters. Bacteriological examination indicated that bacterial contamination is excessively high precluding recreational use. Sphaerotilus, responsible for slime growths in streams and for destroying habitats for various aquatic animals was measured in the adjacent Columbia River. The nutrient levels in Vancouver Lake are quite high and responsible for excessive algal populations. Equipment for measurements of environmental factors is delineated. Trace elements were measured by neutron activation and high resolution spectrometry. (Jones-Wisconsin)
W72-03215

PRIMARY PRODUCTIVITY, CHEMO-ORGANOTROPHY, AND NUTRITIONAL INTERACTIONS OF EPIPHYTIC ALGAE AND BACTERIA ON MACROPHYTES IN THE LITTORAL OF A LAKE, Michigan State Univ., Hickory Corners, W. K. Kellogg Biological Station.

Harold L. Allen. Ecological Monographs, Vol. 41, No. 2, p 97-127, 1971. 33 fig, 13 tab, 18 ref. AEC AT (11-1)-1599 NSF GB-6538.

Descriptors: *Primary productivity, *Eutrophication, *Nutrients, *Biological communities, *Aquatic plants, Algae, Bacteria, Littoral, Lakes, Periphyton, Organic matter, Biomass, Metabolism, Phytoplankton, Plant physiology, Physiological ecology, Organic compounds, On-site tests, Methodology, Chora.
Identifiers: *Epiphytic algae, *Epiphytic bacteria, *Macrophyte-epiphyte metabolism, Lawrence Lake (Mich), Scirpus acutus, Najas flexilis.

Community metabolism of macrophyte-epiphyte systems and nutritional relationships of epiphytic algae and bacteria were investigated by C-14 techniques in the littoral zone of a small lake. The study indicated that epiphytic algae contributed 31.3% to the total littoral production and that the algal epiphytes may be among the dominant producers in shallow-water ecosystems with submerged macrophytes. The chemo-organotrophy of

epiphytic bacteria was evaluated on glucose and acetate substrates by enzyme kinetic analysis. The nature of extracellular release suggests nutritional interactions in macrophyte-epiphyte systems. The metabolism of the two groups of organisms may be a source of dissolved organic matter that contributes to the primary production. (Wilde-Wisconsin)
W72-03216

STUDIES ON THE PHYSIOLOGY OF HETEROCYST PRODUCTION IN THE NITROGEN-FIXING BLUE-GREEN ALGA ANABAENA SP L-31 IN CONTINUOUS CULTURE, Bhabha Atomic Research Centre, Bombay (India). Biology Div.

J. Thomas, and K. A. V. David. Journal of General Microbiology, Vol 66, No 1, p 127-131, 1971. 3 fig, 1 tab, 17 ref.

Descriptors: *Nitrogen fixation, *Cyanophyta, Plant physiology, Cytological studies, Cultures, Ammonia, Potassium compounds, Nitrates, Density, Growth rates, Laboratory tests, Cyanophyta, Algae.
Identifiers: *Heterocysts, *Anabaena sp L-31, Continuous culture, Batch cultures.

Compounds which inhibit heterocyst production in filamentous blue-green algae include nitrate, nitrite, ammonia, and other nitrogenous substances, ammonia being the most effective. Mechanism of this inhibition has not been clearly understood. Studies in batch and continuous cultures of Anabaena sp L-31 are reported to elucidate further the physiology of inhibition of heterocysts. Daily measurements were made of turbidity, cell number, cell size, heterocyst frequency, filament length, and extracellular ammonia. Induction of heterocysts in this alga is totally inhibited by potassium nitrate in batch cultures, whereas in continuous cultures no inhibition is observed at high dilution rates. When nitrate is utilized, ammonia accumulates in the growth medium, the quantity of extracellular ammonia declining with increasing dilution rate. The rate of release of ammonia per cell increases with decreasing density of organisms, and induction of heterocysts is consistently observed when ammonia release per cell exceeds 2×10^{-10} to the 10th power micrograms. It is inferred that such excessive release depletes the level of intracellular ammonia causing the induction of heterocysts. The present results support the view that heterocysts are the possible sites of nitrogen fixation in blue-green algae. (Jones-Wisconsin)
W72-03217

ESTIMATING EUTROPHIC POTENTIAL OF POLLUTANTS, Monsanto Co., St Louis, Mo; and Washington Univ., St Louis, Mo. Dept. of Environmental and Sanitary Engineering.

Dee Mitchell, and James C. Buzzell, Jr. Journal of Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 97, No SA 4, p 453-465, 1971. 5 fig, 3 tab, 22 ref.

Descriptors: *Eutrophication, *Laboratory tests, *Water pollution effects, *Algae, *Plankton, Water pollution control, Methodology, Microenvironment, Measurement.
Identifiers: *Microcosm algal assay procedure, Species diversity index.

This study is concerned with effects of various chemicals and wastewater on the composition and growth of algal microcosms of lake water and bottom mud cultures. The bioassay was conducted in nine liter pyrex bottles filled with 1:7 mud-lake water suspension. The treatments included 10% solution of domestic wastewater, 10% secondary treatment effluent, different concentrations of 23-19-17 fertilizer, and the Algistat herbicide. Effects of these treatments were recorded in terms of the number of algal genera and the total algal cells

count. Nearly all enrichments of the media caused a marked reduction of the diversity index of microorganisms. The results suggested that the laboratory procedure may serve for an appraisal of the effect of different pollutants. (Wilde-Wisconsin)
W72-03218

PHYTOPLANKTON PRIMARY PRODUCTION OFF THE COAST OF HELSINKI (KASVIPLANKTONIN PERUSTUOTANTO HELSINGIN EDUSTAN MERIALUELLA). Helsinki Univ. (Finland). Dept. of Limnology. Pasi O. Lehmusluoto. Suomi Limnological Institute, Eripainos, Limnology Symposium, p 31-42, 1967. 4 fig, 1 tab, 12 ref, English summary.

Descriptors: *Eutrophication, *Primary productivity, *Phytoplankton, Domestic wastes, Sewage, Self-purification, Fjords.
Identifiers: *Gulf of Finland, *Helsinki (Finland), Dilution.

A survey of phytoplankton in the recreational area off the coast of Helsinki, Finland, revealed that discharge of domestic sewage produced severe eutrophication of near-shore waters, expressed by the annual primary production of 1740 kg C/ha. Dilution and self purification reduced the primary production towards the open sea to 300 kg C/ha. (Wilde-Wisconsin)
W72-03219

PARTICULATE CARBON: NITROGEN RELATIONS IN NORTHERN CHESAPEAKE BAY, Maryland Univ., College Park. Natural Resources Inst; and Chesapeake Biological Lab. Solomons, Md. David A. Flemer, and Robert B. Biggs. Journal of Fisheries Research Board of Canada, Vol 28, No 6, p 911-918, 1971. 2 fig, 3 tab, 24 ref.

Descriptors: *Carbon, *Nitrogen, *Organic matter, Spatial distribution, Estuaries, Sediments, Salinity, Suspension.
Identifiers: *Carbon nitrogen ratios, *Chesapeake Bay, Particulate carbon, Particulate nitrogen, Susquehanna River.

Determinations of particulate carbon and particulate nitrogen were made in samples collected in the Chesapeake Bay estuary usually at 0.5 m depth and every 3 m to the depth of 9 or 12 m. Average C/N ratio for the column was between 20 and 30 in the upper part of the estuary, the high values coinciding with the maximum discharge of Susquehanna River. Seaward the ratio averaged less than 20. During the period July to October the ratio was consistently less than 20 in the entire study area. (Wilde-Wisconsin)
W72-03221

REGULATION OF NITRATE REDUCTASE IN CHLORELLA VULGARIS, Cornell Univ., Ithaca, N.Y.; and Agricultural Research Service, Ithaca, N.Y. Plant, Soil and Nutrition Lab. F. W. Smith, and John F. Thompson. Plant Physiology, Vol 48, p 224-227, 1971. 4 fig, 2 tab, 15 ref.

Descriptors: *Biochemistry, *Nitrates, *Chlorella, Enzymes, Proteins, Laboratory tests, Ammonia, Assay, Inhibition, Ureas, Synthesis, Algae.
Identifiers: Chlorella vulgaris, Nitrate reductase, Ribonucleic acid.

Several amino acids were tested as possible inhibitors of nitrate reductase. The results of assays and induction studies disclosed that nitrate reductase is increased in Chlorella vulgaris by an addition of nitrate with maximum induction above mM. Actinomycin D, cycloheximide, and puromycin annulled the effect of nitrate thus indicating that de novo synthesis of messenger RNA and protein is

required. Tests of nitrogenous compounds revealed that ammonium chloride, urea, and several amino acids arrested an increase of the reductase in vivo, but not in vitro. The study suggested that nitrate reduction in Chlorella is controlled by repression of enzyme synthesis. (Wilde-Wisconsin)
W72-03222

INFLUENCE OF ORGANIC MATTER ON SOME CHARACTERISTICS OF AQUATIC SOILS, Auburn Univ., Ala. Agricultural Experiment Station. Claude E. Boyd. Hydrobiologia, Vol 36, No 1, p 17-21, 1970. 2 fig, 8 ref. AEC AT (38-1)-310.

Descriptors: *Organic matter, *Aquatic soils, Alabama, Nitrogen, Cation exchange, Sulfur, Fertilization, Impoundments, Lake soils, Analytical techniques, Lakes.
Identifiers: Mineralization, Fishing lakes.

Contents of organic matter, total nitrogen, sulfur, and cation exchange capacity were determined in samples of aquatic soils collected from 29 fishing lakes. Significant relationship between organic matter and investigated factors was established. The results suggested that methods of agricultural soil analysis are applicable to investigations of lake bottoms. (Wilde-Wisconsin)
W72-03223

STUDIES ON FRESHWATER BACTERIA: FACTORS WHICH INFLUENCE THE POPULATION AND ITS ACTIVITY, Freshwater Biological Association, Ambleside (England). J. G. Jones. The Journal of Ecology, Vol 59, No 2, p 593-613, 1971. 12 fig, 7 tab, 42 ref.

Descriptors: *Aquatic bacteria, *Population, *Algae, *Stratification, *Enzymes, Thermocline, Epilimnion, Mud, Physicochemical properties, Hydrogen ion concentration, Temperature, Dissolved oxygen, Eutrophication, Oligotrophy, Phytoplankton, Analytical techniques, Turbidity, Nitrates, Phosphates, Wind velocity, Rainfall.
Identifiers: Esthwaite Water (England), Lake Windermere (England), Exoenzyme producers, Chlorophyll a.

The factors were studied controlling bacterial populations during the period of water stratification. The analyzed parameters included temperature, pH, dissolved oxygen, turbidity, particulate matter, phosphate, nitrate, rainfall, wind velocity, and chlorophyll a. The density of viable bacteria, exoenzyme producing bacteria, and the levels of certain enzymes were also estimated. In the eutrophic Esthwaite Water the major factors controlling bacteria appeared to be temperature, DO concentration, and pH. In the Lake Windermere a positive correlation was observed between bacterial numbers and pH, temperature, particulate matter, and rainfall. Bacterial population and enzymatic activity occasionally increased with phytoplankton maxima. (Wilde-Wisconsin)
W72-03224

PHYTOPLANKTON PRIMARY PRODUCTION IN THE BALTIC AREA (KASVIPLANKTONIN PERUSTUOTANTO ITAMEREN ELUEELLA), Helsinki Univ. (Finland). Dept. of Limnology. Pasi O. Lehmusluoto. Eripainos, Luonnontutkimus, p 86-91, 1971. 3 fig, 1 tab, 15 ref, English summary.

Descriptors: *Primary productivity, *Phytoplankton, *Sea water, *Eutrophication, Water pollution effects, Water pollution sources, Industrial wastes, Domestic wastes, Pulp wastes.
Identifiers: *Coastal waters, Baltic Sea, Bothnian Bay, Gulf of Finland, Straits of Denmark, Bothnian Sea.

Based on analyses of phytoplankton, eutrophication of polluted coastal waters of the Baltic Sea was expressed by the annual primary production exceeding 170 g C/sq m for the northern part and by 800 g C/sq m for the southern part. In some areas the discharge of wastewaters inhibited production. Outside of the coastal areas, the annual primary production ranged from 10 to 25 g C in the Bothnian Bay, from 15 to 40 g C in the Gulf of Finland, and averaged about 100 g C/sq m in the straits of Denmark. (Wilde-Wisconsin)
W72-03226

THE NATURE OF THE PHOTOSYNTHATE IN NATURAL PHYTOPLANKTON POPULATIONS IN RELATION TO LIGHT QUALITY, Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences. D. G. Wallen, and G. H. Geen. Marine Biology, Vol 10, No 2, p 157-168, 1971. 2 fig, 7 tab, 31 ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Light quality, Pigments, Solar radiation, Light penetration, Energy gradient, Light intensity, Depth, Organic compounds, Metabolism, Wavelengths, Growth rates, Analytical techniques.
Identifiers: Saanich Inlet (British Columbia), Indian Arm (British Columbia), Carbon-14 distribution, Ethanol-soluble fractions, Insoluble compounds.

Samples of C-14 labeled phytoplankton, collected from different depths of the photic zone, were subjected to fractionation analysis. Irrespective of light intensity, the greater share of C-14 in the newly formed compounds was in the ethanol-soluble fraction. The proportion of C-14 in the insoluble fraction increased with the depth. Carbohydrates of the ethanol-soluble fraction decreased, whereas amino acids increased with depth. The release of dissolved organic carbon was directly related to the size of the alcohol-soluble fraction. The trials indicated that light quality, rather than light intensity, is responsible for the observed changes. (Wilde-Wisconsin)
W72-03227

PHYTOPLANKTON PRIMARY PRODUCTION IN SOME FINNISH COASTAL AREAS IN RELATION TO POLLUTION, Institute of Marine Research, Helsinki (Finland); and Helsinki Univ. (Finland). Dept. of Limnology. Pauli Bagge, and Pasi O. Lehmusluoto. Merentutkimuslait Julk/Havsforskingsint Skr No 235, p 3-18, 1971. 7 fig, 4 tab, 24 ref.

Descriptors: *Primary productivity, *Phytoplankton, *Sea water, Coasts, Biorhythms, On-site tests, Water pollution sources, Water pollution effects, Fluctuation, Comparative productivity, Municipal wastes, Industrial wastes, Annual turnover, Energy, Cyanophyta, Algae, Eutrophication, Summer, Energy, Seasonal.
Identifiers: *Finland, *Bothnian Bay, *Gulf of Finland, Dark fixation, Coastal waters, Trophogenic layer.

Carbon-14 analyses disclosed significant annual and seasonal fluctuations of phytoplankton primary production in the polluted and nonpolluted coastal areas of Finland. In some areas, receiving wastewater, the annual production exceeds 150 g C/sq m, in comparison with 15 to 60 g C/sq m of unpolluted waters. Because of the shading plankton, the thickness of the trophogenic layer during the summer in sewage polluted waters is usually less than 2 m; in waters polluted by paper mill wastes, the thickness is under 1 m. The eutrophic waters are dominated by blue-green algae, whereas oligotrophic waters by diatoms and Dinophyceae. Dark fixation values of eutrophic waters may be 10 times as high as those of unpolluted waters. (Wilde-Wisconsin)
W72-03228

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

STUDIES ON THE SPATIAL HETEROGENEITY OF SHALLOW WATER BENTHOS WITH PARTICULAR REFERENCE TO THE CHIRONOMIDAE.
Waterloo Univ. (Ontario). Dept. of Biology.
C. G. Paterson, and C. H. Fernando.
Canadian Journal of Zoology, Vol 49, No 7, p 1013-1019, 1971. 3 tab, 24 ref.

Descriptors: *Distribution patterns, *Sampling, *Insects, *Benthos, *Spatial distribution, Oligochaetes, Diptera, Habitats, Benthic fauna, Lentic environments, Density.
Identifiers: Aggregate distribution, Random distribution.

Variation in microdistribution of lentic benthos is generally assumed the direct result of non-uniformity of the habitat, but there may be a behavioral component of dispersion in certain organisms resulting in a non-random distribution even in a uniform habitat. Heterogeneity in the spatial distribution of most species of macrobenthos in several shallow water habitats was revealed. Chironomus abortivus, Glyptotendipes barbipes, Procladius freemani and the Oligochaeta were invariably aggregated when their population densities were adequate to determine a distributional pattern. The Chironomidae, considered as a group, also displayed an aggregate distribution. Other benthic species had distributional patterns that varied from random to highly aggregated in the different habitats. No evidence was found that any species are normally randomly distributed; analyses suggest that species often respond independently to microenvironmental variations. Laboratory studies with Glyptotendipes barbipes and Chironomus abortivus suggest that the clumping found in field situations with appreciable population densities is a product of microenvironmental variation and not a result of behavioral clumping in a near uniform environment. (Jones-Wisconsin)
W72-03229

SPRING AND SUMMER CHIRONOMIDAE OF UNIVERSITY LAKE, CHAPEL HILL, NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Jane M. Hartley.
MS Thesis in Public Health, Dept. of Environmental Sciences and Engineering, North Carolina Univ., Chapel Hill. 35 p. 1971. 4 fig, 4 tab, 44 ref.

Descriptors: *Diptera, *Invertebrates, *Seasonal, North Carolina, Midges, Reservoirs, Benthos, Larvae, Ecological distribution, Distribution patterns, Anaerobic conditions, Aerobic, Depth, Size, Sampling, Computer programs, Bioindicators, *Diptera, Indicators, Benthic fauna, Larvae.
Identifiers: Chapel Hill (NC), University Lake (NC), Chironomus, Procladius, Cricotopus, Tribelos.

The significance of the Chironomidae prompted consideration of their larvae as indicator organisms. Since their taxonomy is mainly based on adult morphology, larval specimens cannot always be identified to species without rearing. Lack of information on Chironomids in North Carolina prompted their study in the Chapel Hill University Lake. Chironomid larvae live in the bottom substratum at all depths. Size distribution was analyzed for each genus, mean size calculated, and a statistical value formulated for each genus with at least ten individuals. The formula was programmed and computed. Twenty-seven genera of Chironomid larvae were identified from spring and summer samples. The dominant genera, Chironomus and Procladius were located in all benthic areas. They were the only genera found in the deepest stations (anaerobic in summer and void of debris). All other genera, except Cricotopus and Tribelos, found only on floating objects, were located throughout the other stations with aerobic conditions and varying amounts of debris. While variety of genera was high, densi-

ties were low. The dominant genus averaged 120 individuals sq m. (Jones-Wisconsin)
W72-03231

AQUATIC FORAGE PROCESSING IN FLORIDA.
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
L. O. Bagnall, T. W. Casselman, J. W. Kesterson, J. F. Easley, and H. E. Hellwig.
American Society of Agricultural Engineers, Paper No 71-536, 1971. 41 p, 11 fig, 6 tab, 15 ref.
OWRR A-017-FLA (2).

Descriptors: *Aquatic weed control, *Aquatic plants, *Mechanical equipment, *Forages, De-watering, Florida, Forage palatability, Aquatic weeds, Design, Proteins, Feeds, Water hyacinth, Harvesting.
Identifiers: *Eichhornia crassipes, *Hydrilla verticillata, Processing, Pelleting, Screw presses, Dehydrators.

In the tropics and subtropics, aquatic weeds have become a major problem, yet nutrient production for human and animal consumption has become an even more serious problem. In Florida millions are spent to control aquatic weeds chemically, while farmers import forage. Two aquatic plants, water hyacinth (Eichhornia crassipes) and Florida elodea (Hydrilla verticillata) were studied. Three systems for processing them for forage were evaluated and a fourth for pelleting. Plants were chopped, mechanically dewatered, dehydrated, and pelleted to determine the effectiveness and efficiency of these existing processing systems and components. 60 to 80% of the water and 18 to 38% of the dry matter were removed mechanically. The pressed product is difficult to dry. The mobile press-stationary dehydrator system was the most satisfactory. Production rate approached the capacity of the system and efficiencies were satisfactory. Because insufficient water was removed by the press, energy cost per unit of dry matter makes the system uneconomic. The difference between the citrus pulp pilot plant and the mobile press-stationary dehydrator systems are size and material handling. Off-season use of citrus pulp processing plants may be possible. The product can be pelleted into dense, durable pellets. (Jones-Wisconsin)
W72-03233

IMPORTANCE OF TRITIUM IN THE CIVIL DEFENSE CONTEXT.
Lawrence Radiation Lab. California Univ., Livermore.
For primary bibliographic entry see Field 05B.
W72-03308

HEALTH PHYSICS ASPECTS OF LRL TRITIUM RELEASE.
Lawrence Radiation Lab. California Univ., Livermore.

D. S. Myers, J. F. Tinney, and P. H. Gudiksen.
Available from the National Technical Information Service as UCRL-73310. \$3.00 per copy, \$0.95 microfiche. Report UCRL-73310, July 1971. 18 p.

Descriptors: *Accidents, *Radioactivity, *Tritium, Environmental effects, *Monitoring, *Sampling, Analytical techniques, Pollutant identification, Air pollution, Water pollution.
Identifiers: Radioactivity release, Concentration, Monitor environment, Emergency.

Reports tritium accidentally released from an exhaust stack at LRL. Emergency-response personnel surveyed the site with portable tritium air monitors and an extensive environmental sampling program was initiated. The results from this environmental and bioassay sampling program indicate that no significant exposure to on- or off-site individuals resulted from the release. All samples of water, milk, and urine contained normal background levels of tritium. Although detectable

levels of activity were found in some vegetation and atmospheric water vapor samples, the highest measured concentrations as well as the calculated maximum credible ground-level air concentrations during cloud passage were well below the off-site maximum permissible concentrations for continuous exposure. If all of the tritium was assumed to be converted to the oxide form, the calculated maximum exposure at the site boundary as a result of exposure to the cloud would be 300 mrem. (Houser-ORNL)
W72-03311

RADIOLOGICAL SIGNIFICANCE OF 100-N SANITARY WATER.
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05F.
W72-03313

RADIOACTIVITY IN THE MARINE ENVIRONMENT - A SUMMARY REPORT.
National Academy of Sciences. National Research Council, Washington, D.C.
Michael Waldichuk.
Available from the National Technical Information Service as WASH-1185. \$3.00 per copy, \$0.95 microfiche. Report WASH-1185, 1971, 28 p.

Descriptors: *Waste water disposal, *Waste water (Pollution), *Effluents, *Nuclear explosion, *Fallout, Oceans, Oceanography, Ocean circulation, Water distribution, Sediment distribution, Aquatic life, Marine animals, Fish, Radioactive wastes, Radioactivity effects.
Identifiers: Deposition, Nuclear detonation, Nuclear explosion debris, Airborne release.

An informative convenient format which updates and summarizes our knowledge of radioactivity in the marine environment. It summarizes the state of knowledge on injection, dispersal, uptake by the biota, transfer through the food web, effects on the ecosystem, and ultimate disposition of artificial radionuclides in the marine environment. Essentially all the relevant disciplines involved in the marine environment have been covered and most often there is a strong interdisciplinary character in the treatment. (Houser-ORNL)
W72-03317

NEED FOR BETTER INFORMATION OF EFFECTS OF COASTAL REACTORS.
Scripps Institution of Oceanography, La Jolla, Calif.
T. R. Folsom.

Available from the National Technical Information Service as TID-25774. \$3.00 in paper copy, \$0.95 in microfiche. Report TID-25774 Rev July 15, 1971. 16 p.

Descriptors: *Nuclear wastes, *Monitoring, *Pacific Coast Region, Tritium, Ocean currents, Cobalt radioisotopes, Nuclear powerplants, Sites, Mollusks, Marine algae, On-site investigations, California, Food chains, Public health, Water pollution sources.

Uptake by organisms is the most sensitive known indicator of radionuclide pollution. Co-58 and probably Co-60 and Ag-110m were detectable in a species of red algae and in a mollusk that feeds upon the algae, which were collected from an area near the San Onofre Nuclear Powerplant. The tritium discharge reaches 11,000 TU at outfall, an amount sufficient to serve as a tracer of the effluent in the La Jolla-San Diego coastal region. (Bopp-ORNL)
W72-03324

THE ALGO-AGRO-INDUSTRIAL COMPLEX. AN AGRO-INDUSTRIAL COMPLEX AT NUCLEAR ENERGY CENTERS WITH AS-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

SOCIATED PRODUCTION OF AUTOTROPHIC MICROORGANISMS, Československa Akademie Ved, Prague. Inst. of Microbiology; and Československa Akademie Ved, Trebon. Lab. of Algology. For primary bibliographic entry see Field 03A. W72-03327

RADIATION DOSE LIMITS. Maryland Academy of Sciences, Baltimore. Study Panel on Nuclear Power Plants. For primary bibliographic entry see Field 05G. W72-03332

PROGRESS REPORT, BIOLOGY AND HEALTH PHYSICS DIVISION, ENVIRONMENTAL RESEARCH BRANCH, APRIL 1 TO JUNE 30, 1971, Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs. C. A. Mawson. Available from the National Technical Information Service as AECL-4052, \$3.00 in paper copy, \$0.95 in microfiche. Report AECL-4052, p 25-36, 1971. 3 fig, 8 ref.

Descriptors: *Environmental effects, *Radioactivity effects, *Food chains, Radioisotopes, Absorption, Nuclear wastes, Strontium radioisotopes, Carbon radioisotopes, Calcium, Water pollution effects, Rivers, Streams, Ultimate disposal, Solid wastes, Phytoplankton, On-site investigations, Freshwater fish, Radioactive techniques, Primary productivity, Marking techniques, Path of pollutants, Soil contamination, Soil-water-plant relationships, Canada. Identifiers: Cesium radioisotopes, Ottawa River, Strontium, Calcium radioisotopes, Environmental survey.

Seepage from the Liquid Waste Disposal Area contaminated streams within the exclusion area with tritium (0.3-5 microCi/liter), Sr-90, and Co-60; but activity of effluents discharged to the Ottawa River was less than 1% of the ICRP 40-hr occupational MPC for water, and most Sr-90 and Cs-137 in the river resulted from weapons fallout. Temperature and age of fish had little effect on uptake and discrimination in a double-tracer experiment with Sr-85 and Ca-47. Other research included: CO-60 and Cs uptake by plants from various soils, stable Sr as a fish marker, screening for effects of chlorinated hydrocarbons in water on Sr/Ca metabolism by fish, filtration errors in the C-14 measurement of primary productivity, effect of silica on phytoplankton, distribution and specific activity of Sr in lake sediment, movement of radionuclides at the glass block disposal site, analysis of beaver and muskrat for radionuclides, and low-background beta counting. (Bopp-ORNL) W72-03334

AMCHITKA BIOENVIRONMENTAL PROGRAM: SIMULATION STUDIES AS RELATED TO THE ECOLOGICAL EFFECTS OF UNDERGROUND TESTING OF NUCLEAR DEVICES ON AMCHITKA ISLAND, Memorial Inst., Columbus, Ohio. Columbus Labs. S. G. Bloom, and G. E. Raines. Available from National Technical Information Service as BMI-171-138, \$3.00 in paper copy, \$0.95 in microfiche. Report BMI-171-138, July 1971. 22 p, 2 fig, 7 tab, 18 ref. AEC Contract AT (26-1)-171.

Descriptors: *Radioisotopes, *Absorption, *Fish, *Food chains, Water pollution effects, Radioactivity effects, Mathematical models, Ecosystems, Nuclear explosions, Fallout, Forecasting, Estimating, Public health, Nuclear wastes, Alaska, Neutron absorption. Identifiers: Amchitka Island, Japan.

On the basis of a hypothetical release for a Milrow-type device through venting of fission products and rock activation products a conservative dose estimate from consumption of con-

taminated fish for the average Japanese diet is 0.20 rem. It was impossible to provide estimates of the contribution from device activation products or residual fissionable materials. This estimate is the total from the 47 most important of the radionuclides which it is possible to consider. Results for individual radionuclides are classified. Using an unclassified source-term estimate for tritium, the dose from tritium is negligible (9.5×10^{-8} th rem the first year). (Bopp-ORNL) W72-03335

DISPOSAL OF RADIOACTIVE WASTES INTO RIVERS, LAKES AND ESTUARIES, International Atomic Energy Agency, Vienna (Austria). For primary bibliographic entry see Field 05G. W72-03343

AMCHITKA RADIOBIOLOGICAL PROGRAM, Washington Univ., Seattle. Coll. of Fisheries. E. E. Held. Available from National Technical Information Service, \$3.00 in paper copy, \$0.95 in microfiche. Progress Report, July 1970-April 1971, NVO-269-11, July 1971. 38 p, 5 fig, 9 tab, 13 ref. AEC Contract No. AT (26-1)-269.

Descriptors: *Nuclear explosions, *Water pollution effects, *Radioactivity effects, Underground, Alaska, Ponds, Wells, Fish, Bays, Air pollution effects, Air pollution, Water pollution, Lichens, Soil-water-plant relationships, Marine algae, Mosses, Crabs, Algae, Snails, Mussels, Isopods, Amphipoda, Radioisotopes, Absorption, Pacific Ocean, Food chains, Fallout, Tritium, Ecology, On-site investigations, Monitoring. Identifiers: Radionuclide uptake.

Organisms, water, and air samples were analyzed for radionuclides to determine whether there was any release after underground nuclear tests. Excepting tritium (3600 T.U. in ponds and test wells) and short-lived scandium-46 which could be from a nuclear-powered vessel, the radionuclides detected were from worldwide fallout. In fish, iron-55 was as great as 152 pCi/g dry weight (or 254 pCi/mg Fe specific activity) and other radionuclides (excepting K-40) were less than 5 pCi/g dry weight. In lichens, cesium-137 was 20 pCi/g dry weight. In freshwater plants, zirconium-95, niobium-95 was 12 pCi/g dry weight. Generally, the concentrations of the radionuclides were small and within the range of values reported for similar samples from other parts of the northern hemisphere. (Bopp-ORNL) W72-03347

TRITIUM: DISCRIMINATION AND CONCENTRATION IN FRESH WATER MICROCOSMS, Argonne National Lab., Ill. M. L. Stewart, G. M. Rosenthal, and J. R. Kline. Available from National Technical Information Service as CONF-710501-26, \$3.00 in paper copy, \$0.95 in microfiche. Report CONF-710501-26, May 1971. 29 p, 9 fig, 1 tab, 10 ref.

Descriptors: *Snails, *Frogs, *Tritium, Absorption, Water pollution effects, Radioactivity effects, Radioactivity techniques, Aquaria, Algae, Mathematical models, Path of pollutants, Tracers, Animal physiology, Nuclear wastes.

Tritium mobility was studied in an aquatic environment and in aquatic animals (two species of snail and one species of tadpole). The tritium mobility in snails was described by an empirical, compartmental model. Compartments and residence times of tritium are: extracellular, unbound water (80% of the unbound water within the snail shell), 4 minutes; cellular, unbound water (20% of the unbound water within the snail shell), 330 minutes; cellular, bound tritium (accounting for 28% of the exchangeable hydrogen), 2,650 minutes; extracellular, bound tritium (accounting for 28% of the exchangeable hydrogen), 8 minutes; surface,

bound tritium (which is directly exposed to environmental tritium and accounts for 4% of the exchangeable hydrogen), 2 minutes. Compartmental sizes and rate transfer coefficients are given. (Bopp-ORNL) W72-03348

RADIOLOGICAL PHYSICS DIVISION ANNUAL REPORT, Argonne National Lab., Ill.

Available from the National Technical Information Service as ANL-7760, Part 3, \$3.00 in paper copy, \$0.95 in microfiche. Environmental Studies, July 1969 through December 1970, Report ANL-7760, Part 3. 269 p.

Descriptors: *Tritium, *Nuclear wastes, *Environmental effects, *Air pollution, Pollution abatement, Great Lakes, Lake Michigan, Meteorology, Gamma rays, Radioisotopes, On-site investigations, Control, Water pollution control, Analytical techniques, Laboratories, Path of pollutants, Plant ecology, Transpiration, Ecosystem, Soil water movement, Soil-water-plant relationships, Absorption, Nuclear powerplants, Fallout, Radioactivity techniques. Identifiers: Radionuclide uptake.

Research projects (27 in number) are listed under the divisions: Great Lakes research program (10), meteorology and air pollution (10), terrestrial ecology (2), fallout studies (2), and methods and techniques (3). The projects on environmental radiation include: a survey of gamma-emitting nuclides in the biota near the 70-Mw Big Rock Point reactor on Lake Michigan which has been in operation since 1963, compartmental transfer of tritium injected into an old-field ecosystem, transpiration of plants using tritiated water as a tracer, recent trends in radioactive fallout, and high altitude radioactivity measurements. (Bopp-ORNL) W72-03349

PESTICIDE POLLUTION AND THE EFFECTS ON THE BIOTA OF CHEW VALLEY LAKE, Bristol Waterworks (England).

L. R. Bays. Environ Pollut. 1 (3): 205-234. Illus. Maps. 1971. Identifiers: Algal Biota, Blooms, Bosmina, Chew, Chironomids, Daphnia, Dip, England, Lake, Pesticide, Pollution, Residues, Sheep, Valley.

Pesticides arising from sheep dip residues deposited some miles away on the land passed into an underground storage system and eventually into a feeder stream of the Chew Valley lake. They either killed or prevented the reproduction of Daphnia sp., Bosmina sp. and some Chironomid larvae. The crustaceans had been grazing on unicellular algae, which, in their absence, caused a severe algal bloom, which made the water supply temporarily unpotable.—Copyright 1971, Biological Abstracts, Inc. W72-03361

ACCELERATED EUTROPHICATION OF LAKES IN THE UNITED STATES: ECOLOGICAL RESPONSE TO HUMAN ACTIVITIES, Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest Water Lab. A. F. Bartsch. Environ Pollut. 1 (2): 133-140. Illus. 1970. Identifiers: Accelerated, Ecological, Eutrophication, Human, Lakes, Nutrients, Plant, Sewage.

Whatever the natural rate of eutrophication may be, the influences of human cultural activities typically accelerate the process, often leading to drastic disturbances of freshwater ecosystems and highly undesirable results. Various known actions may lead to rearrangement of plant nutrients in the environment or to making them far more easily accessible than is normal for biological use and processes. Notable sources of nutrients or bases of change are municipal sewage and urban

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drainage, select industrial wastes, rural lands with their agricultural uses, and atmospheric precipitation. The most promising remedial approaches will be those which curtail the nutrient input to the aquatic system.—Copyright 1971, Biological Abstracts, Inc.
W72-03373

PRELIMINARY STUDY OF VARIATIONS IN VITAMIN B 12 IN THE GENEVA AND NANTUA LAKES: CONSEQUENCES OF THESE VARIATIONS FOR THE BIOLOGICAL EVOLUTION OF THE LAKES.

Institut National de la Recherche Agronomique, Thonon-les-Bains (France). Station d'hydrobiologie Continentale.
Danielle Gerome.

C R Hebd Seances Acad Sci Ser D Sci Natur (Paris). 272 (6): 808-811. 1970.

Identifiers: Algae, B-12, Biological, Evolution, France, Geneva, Lakes, Nantua, Pollution, Variations, Vitamin.

The vitamin B 12 contents of water from Lake Geneva from June to Nov, 1970, was determined. Comparative measurements were done on Nantua Lake. An increase in this vitamin contents in water samples of Lake Geneva, influenced by urban waste water pollution, has the threat of causing the unfavorable development of algae such as was the case for Lake Nantua. The increased levels in deep water are probably due to the activity of B 12, producing bacteria present in the sediments or in clear water. Surface B 12 level is lower in summer. The reduction of this vitamin in sewer water by an appropriate treatment may be a remedy in the case of Lake Geneva and other lakes presenting the same problem.—Copyright 1971, Biological Abstracts, Inc.
W72-03378

ECOLOGICAL CHANGES IN THE LAKE OF OTTERSTEDT (W. GERMANY) DURING THE COURSE OF THE POST-GLACIAL TIME. (LIMNOLOGICAL INVESTIGATIONS ON LOWER SAXONIAN INLAND WATERS IX), Bundesanstalt fuer Bodenforschung, Hanover (West Germany). Helmut Mueller.

Ber Naturhist Ges Hannover. 114. 33-47. Illus. 1970.

Identifiers: Ecological, Fauna, Flora, Geological, Germany, Human, Inland, Lake, Limno, Micro, Otterstedt, Pollen, Postglacial, Quillwort-D, Samples, Saxonian, Time.

Together with determinations of heat loss, analyses of animal micro-residues and of the pollen were carried out on samples of postglacial sedimentations of the Lake of Otterstedt (east of Bremen). Relations between the changes of the vegetation in the environment and the ecological conditions within the lake were found. The lake which today is slightly eutrophic was originally considerably more oligotrophic. Since the Neolithic, during stronger human population phases in the environment of the lake, the plankton species increased respectively while the bottom flora, especially the quillwort was still present in the lake a few centuries ago, with the microfauna living on it, decreased.—Copyright 1971, Biological Abstracts, Inc.
W72-03379

THE VALIDITY OF SAPROBIC RULE IN SALT-CONTAMINATED INLAND WATERS, Wasserwirtschaftsleitung Wera-Gera-Unstrut, Erfurt (East Germany). Horst Ziemann.

Limnologica. 7 (2): 279-193. Illus. 1970.

Identifiers: Ciliata, Contaminated, Inland, Nutritional, Oxygen, Rule, Salt, Saprobic, Validity.

The validity of the saprobic rule in salt-contaminated water was studied by analyzing the ecology of saprobes in salt-contaminated stretches

of the rivers Werra, Wipper and Helbe, by determining the maximal tolerated salt concentrations for Ciliata of the saprobic system, by a comparison of chemical and biological water test results and by a statistical evaluation of the data gathered in the study. The quantitative relationship between saprobes and O₂ balance in highly salt-contaminated waters was found to differ from that in limnetic waters. In salt contaminated water the formation of saprobic societies is not governed by the O₂ balance alone but to a large extent also by the nutritional factor.—Copyright 1971, Biological Abstracts, Inc.
W72-03380

HYDROCARBONS OF MARINE PHYTOPLANKTON,

Woods Hole Oceanographic Institution, Mass. M. Blumer, R. R. L. Guillard, and T. Chase. Mar Biol (Berlin). 8 (3): 183-189. Illus. 1971.

Identifiers: Carbons, Chain, Dynamics, Food, Hydro, Marine, Phyto, Plankton, Pollutants, Rhizosolenia-Setigera, Synechococcus-Bacillaris.

The hydrocarbon contents of 23 spp. of algae (22 marine planktonic), belonging to 9 algal classes, were analyzed. The highly unsaturated 3,6,9,12,15,18-heneicosahexaene predominates in the Bacillariophyceae, Dinophyceae, Cryptophyceae, Haptophyceae and Euglenophyceae. Rhizosolenia setigera contains n-heneicosane, presumably derived from the hexaolefin by hydrogenation. Two isomeric heptadecenes have been isolated: the double bond is located in 5-position in the blue-green alga Synechococcus bacillaris and in 7-position in 2 green algae. Complete analyses are discussed in the context of earlier data; some generalizations appear no longer valid. Hydrocarbon analysis of marine algae should provide a tool for the investigation of the dynamics of the marine food chain. Knowledge now available provides the background needed for distinguishing between hydrocarbons of recent biogenic origin and hydrocarbon pollutants from fossil fuels.—Copyright 1971, Biological Abstracts, Inc.
W72-03382

SATURATED AND UNSATURATED HYDROCARBONS IN MARINE BENTHIC ALGAE,

Florida Technological Univ., Orlando. Dept. of Chemistry. W. W. Youngblood, M. Blumer, R. L. Guillard, and F. Fiore.

Mar Biol (Berlin). 8 (3): 190-201. Illus. 1971.

Identifiers: Algae, Ascophyllum-Nodosum, Benthic, Calanus-Helgolandicus, Carbons, Coastal, Enteromorpha-Compressa, Food, Hydro, Marine, Saturated, Ulva-Lactuca, Unsaturated, Web.

Saturated and olefinic hydrocarbons were determined in 24 spp. of green, brown and red benthic marine algae from the Cape Cod area (Massachusetts, USA). Among the saturated hydrocarbons, n-pentadecane predominates in the brown and n-heptadecane in the red algae. A C17 alkylcyclopropane has been identified tentatively in Ulva lactuca and Enteromorpha compressa, 2 species of green algae. Mono- and diolefinic C15 and C17 hydrocarbons are common. The structures of several new C17, C19 and C21 mono- to hexaolefins have been elucidated by gas chromatography, mass spectrometry and ozonolysis. In fruiting Ascophyllum nodosum, the polyunsaturated hydrocarbons occur exclusively in the reproductive structures. The rest of the plant contains n-alkanes from C15 to C21. A link between the reproductive chemistry of benthic and planktonic algae and their olefin content is suggested. An intriguing speculation is based on Paffenhofer's (1970) observation that the sex ratio of laboratory reared Calanus helgolandicus depends upon the species of algae fed to the nauplii. The percentage of males produced correlated with our analyses of heneicosahexaene in the algal food. Analyses of the hydrocarbons in benthic marine algae from

coastal environments should aid studies of the coastal food web and should enable us to distinguish between hydrocarbon pollutants and the natural hydrocarbon background in inshore waters.—Copyright 1971, Biological Abstracts, Inc.
W72-03383

STUDIES ON THE MICROBIOLOGY OF THE NEUSTON,

Ernst-Moritz-Arndt-Univ., Greifswald (East Germany). Inst. of Mikrobiologie. Hans-Dietrich Babenzien, and Wilhelm Schwartz. Limnologica. 7 (2): 247-272. Illus. 1970.

Identifiers: Bacterial, Count, Microbiology, Neuston, Nevskia-Ramosa.

High surface tension of the water, a special radiation climate, the concentration of organic nutrients and a redox potential favorable for aerobic organisms are the factors which characterize the neuston biotope as the marginal surface between air and water. The bacterial count in the neuston is in the area of 10⁶/cm². In contrast to the count in the water itself it shows no relationship to the various conditions of the water. Considering the deciding factors for a mass development of bacteria (nutrient accumulation on the marginal surface or the solid surface effect) neuston formation represents an analogue to growth formation. In both cases the increase of bacteria can lead to almost closed surface forming associations with high metabolic activity. Above all the heavy production of slime serves to anchor the cells to the marginal surface. The dichotomously branched colonies of Nevskia ramosa were, however, only found in the neuston. Fatty acids and lipids are a preferred substrate for a large number of neuston strains studied.—Copyright 1971, Biological Abstracts, Inc.
W72-03388

LONGITUDINAL VARIATION OF PERIPHYTON PRODUCTIVITY IN SKELETON CREEK, OKLAHOMA,

Oklahoma State Univ., Stillwater. Dept. of Zoology.

James M. Cooper, and Jerry L. Wilhm. Proc Okla Acad Sci. 49: 19-22. Illus. 1970.

Identifiers: Creek, Curve, Growth, Linear, Longitudinal, Model, Oklahoma, Periphyton, Pollution, Productivity, Regression, Skeleton.

Periphyton biomass was sampled using artificial substrata over a series of increasing exposure times in an enriched stream. A growth curve was plotted and analyzed by a discontinuous linear regression model. The maximum instantaneous growth rate was used to estimate productivity. Productivity decreased downstream from the pollution outfall.—Copyright 1971, Biological Abstracts, Inc.
W72-03390

SEASONAL EFFECTS OF OIL POLLUTION ON SALT MARSH VEGETATION, University Coll. of Swansea (Wales). Jennifer M. Baker.

Oikos. 22 (1): 106-110. Illus. Maps. 1971.

Identifiers: Development, Festuca-Rubra-M, Flowering, Germination, Juncus-Gerardii-M, Marsh, Oil, Plantago-Maritima-D, Pollution, Salt, Seasonal, Seed, Spartina-X-Townsendii-M, Suaeda-Maritima-D, Vegetation.

Salt marsh transects near Pembroke, SW Wales, were experimentally sprayed with fresh Kuwait crude oil at different times of year, and recovery measured using a points frame. There was little long term vegetative damage to most perennial species, but in the case of the annual Suaeda maritima damage was severe, and was further investigated using density and dry weight measurements. Flower density measurements for Juncus gerardii, Festuca rubra, Plantago maritima, and Spartina x townsendii, showed that marked reduc-

tion of flowering can occur if plants are oiled when the flower buds are developing. Flowers, if oiled, rarely produce seeds. Oiling of seeds during winter may reduce germination in the spring.—Copyright 1971, Biological Abstracts, Inc. W72-03395

YEAST FLORA OF RESERVOIRS CONTAMINATED WITH OIL-PRODUCTS, Akademiya Nauk USSR, Kiev. Inst. of Microbiology and Virology. I. P. Shchokolova, and V. P. Bykova. Mikrobiol Zh (Kyyiv). 32 (5): 642-644. 1970 Russian and English summary. Identifiers: Assimilation, Candida, Carbon, Contaminated, Flora, Hansenula, Hydro, Oil, Products, Reservoirs, Rhodotorula, Saccharomyces, Torulopsis, Trichosporon, USSR, Yeast.

The yeast flora was studied in contaminated and uncontaminated reservoirs. Yeasts of the genera *Candida*, *Torulopsis*, *Rhodotorula*, *Trichosporon*, *Saccharomyces* and *Hansenula* were isolated. Uncontaminated reservoirs supported species which did not assimilate n-alkanes more often. The strains of yeast from the reservoirs contaminated with oil-products assimilate oil hydrocarbons more than strains of the same species isolated from the Dnieper water and fresh lakes. Oil-products influence the selection of active strains of hydrocarbon oxidizing yeast.—Copyright 1971, Biological Abstracts, Inc. W72-03402

EFFECT OF FISH POISONS ON WATER SUPPLIES, PART 1 - REMOVAL OF TOXIC MATERIALS, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. For primary bibliographic entry see Field 05F. W72-03410

MERCURY IN FISH AND WATER FROM A RIVER AND A FJORD IN THE KRAGERO REGION, SOUTH-NORWAY, Norges Veterinarhøgskole, Oslo. For primary bibliographic entry see Field 05A. W72-03411

STUDIES ON THE EFFECTS OF SEVERAL AGRICULTURAL CONTROL CHEMICALS ON THE SPAWNING OF WILD GOLDFISH (*CARASSIUS CARASSIUS CUVIERI* T. ET S.) AND THE HATCHING OF THE EGGS, Fisheries Agency, Tokyo (Japan). Sekio Kimura, and Masahiro Matsushima. Bull Freshwater Fish Res Lab Tokyo. 19 (2): 121-135. Illus. 1969. In Japanese with English summary. Identifiers: Agricultural, Carassius-Carassius-Cuvieri, Chemicals, Control, Eggs, Goldfish, Hatching, Spawning, Wild.

The insecticide chemicals tested did not affect adult wild goldfish, their spawning ability and the eggs at the concentration of 0.1 x 48 hr-TLM (median tolerance limits) for carp fry. Deleterious effects were observed at concentrations higher than 0.5 x 48 hr-TLM. Long term experimental studies are required to understand the effect of the chemicals such as chlorinated hydrocarbons which easily accumulate in fish and which toxicity remains for a long time in the water.—Copyright 1971, Biological Abstracts, Inc. W72-03413

A PRELIMINARY STUDY OF THE DANGERS INVOLVED IN THE USE OF 2, 4, 5-T IN THE FOREST, Hochschule fuer Bodenkultur, Vienna (Austria). Institut fuer Forstliche Standortsforschung. Marvin L. Montgomery, and Logan A. Norris. Bodekult. 21 (4): 425-431. 1970. Identifiers: Acetic-Acid, Animal, Chlorophenoxy, Dangers, Fish, Forest, Herbicide, Pollution, Tri.

The use of 2,4,5-trichlorophenoxyacetic acid (2, 4, 5-T) causes a slight temporary water pollution. There is no significant danger to fish or other animals. The extensive absorption and degradation of 2, 4, 5-T in forest soils hinders its later displacement from treated areas to open water and subsoil water. Rainfall, dilution by growth and degradation reduce the residue of the herbicide in the vegetation within several weeks. 2, 4, 5-T has a low toxicity; it is not permanent in the soil or in plants and is quickly eliminated by animals.—Copyright 1971, Biological Abstracts, Inc. W72-03415

ANNUAL REVIEW OF ECOLOGY AND SYSTEMATICS, VOL. 1, Richard F. Johnston. Annual Reviews Inc.: Palo Alto, Calif., 1970. 406 p. Identifiers: Annual, Book, Ecology, Fungi, Human, Mammals, Review, Systematics.

This new series, devoted to knowledge of ecologic or taxonomic groups, habitats and ecosystems, encourages reviews of current resource management, systems analysis and human ecology in an effort to generate interest where a potential for major advance exists. This 1st volume contains 15 papers of considerable range. Three papers are definitive and philosophical in nature, noting the principles of natural selection and evolutionary theory, contemporary systematic philosophies and character variation. The application of statistics in ecology is considered noting models and hypotheses. Other topical subjects reviewed include: the ecology of tropical savannas and lichen-forming fungi; endogenous rhythmicity; refuting; dominance; pollution mechanisms and reproductive characteristics; seed characterization; and the Mesozoic mammalian evolution. Technical papers include the strategy of mineral cycling and high temperature systems. Each contribution is concluded by an extensive bibliography, and there is an index to authors cited, as well as a subject index.—Copyright 1971, Biological Abstracts, Inc. W72-03416

EXPERIMENTAL STUDIES ON ELIMINATION OF ZINC-65, CESIUM-137 AND CERIUM-144 BY EUPHAUSIIDS, South Carolina Univ., Columbia. Baruch Inst. of Estuarine and Littoral Science. For primary bibliographic entry see Field 05A. W72-03423

DEATH CASES IN NEWBORNS CAUSED BY PSEUDOMONAS AERUGINOSA CONTAMINATED DRINKING WATER, Vienna Univ. (Austria). Hygiene Inst. G. Weber, H. P. Werner, and H. Matschnigg. Zentralbl Bakteriell Parasitenk Infektionskrankh Hyg Abt I Orig. 216 (2): 210-214. 1971. English summary. Identifiers: Borns, Brook, Contaminated, Death, Drinking, Funicular, New, Pseudomonas-Aeruginosa, Seepage, Sepsis, Sewage.

Ten new-borns contracted funicular sepsis caused by *P. aeruginosa*; 3 died. Epidemiological investigations led to the source of infection, which was drinking water from a fecally contaminated dug well. This well was contaminated both by a nearby brook carrying masses of fecal matter and sewage seepage. The connection between contamination of drinking water and further epidemiologically unclear diarrhea cases and hepatitis is discussed. Bacteriological routine examinations of drinking water, besides Enterobacteria and fecal Streptococci, should include *P. aeruginosa*, since the latter agent must be regarded as a fecal indicator. Drinking water hygiene and on-the-spot-examinations must be intensified.—Copyright 1971, Biological Abstracts, Inc. W72-03436

ANIONIC DETERGENT AND CHLORINE CONCENTRATIONS IN POLDER DITCHES IN A FORMER MALARIOUS AREA: WALCHEREN ISLAND, ZEELAND PROVINCE, THE NETH., Institute of Tropical Hygiene, Amsterdam (Netherlands). H. A. Van Seventer. Environ Pollut. 1 (2): 105-117. Illus. Maps. 1970. Identifiers: Anionic, Auopheline, Breeding, Chlorine, Detergent, Detergents, Ditches, Extermination, Island, Malarious, Mosquito, Netherlands, Polder, Pollutant, Province, Side, Walcheren, Water, Zealand.

Since 1958, malaria is no longer autochthonous in the Netherlands. One of the factors contributing to this fact must have been the pollution of water with detergents in the breeding sites of the anopheline mosquitoes. By 1968 the mosquito population had decreased considerably compared with the years just after World War II, except on the island of Walcheren, located in the province of Zeeland, and a former malarious area. In June 1968, about 400 water samples from the island were analyzed for detergent concentration, and enough suitable breeding sites were found to support the amopheline population. However, in Oct. 1969, 153 pig farms were searched for adult mosquitoes semihibernating in these farms. The number of mosquitoes had decreased compared with the mosquito population in the same pigsties in 1968. This could not be caused exclusively by the intensified use of insecticides. The amount of rain in July, after the water samples were taken, was much lower than normal, so that the detergent concentration in the water of the breeding sites must have risen to a degree in which the larvae could not survive. The decrease of the malaria vector is so far the only positive side-effect to which water pollution by detergents has contributed.—Copyright 1971, Biological Abstracts, Inc. W72-03437

INTERACTIONS, Cincinnati Univ., Ohio. Kettering Lab. Mitchell R. Zavon. Bioscience. 19 (10): 892-895. Illus. 1969. Identifiers: Human, Interactions, Pollutants.

The possible interactions of foods, food additives, drugs, pesticides, water pollutants and air pollutants (whether naturally occurring or man-made) and electromagnetic energy are discussed. The effects of pollutants on human health must be considered as additive and interactive.—Copyright 1971, Biological Abstracts, Inc. W72-03438

TOXICOLOGIC-HYGIENIC NATURE OF PHTHALOPHOS AND STANDARDS FOR WATER BODIES, All-Union Research Inst. of Hyg. Toxic. Pesticides, Polymers, Plastics, Kiev (USSR). K. K. Vrochinskii, and L. P. Danilenko. Gig Sanit. 35 (12): 94-96. 1970. Identifiers: Bodies, Cat, Hygienic, Nature, Organoleptics, Phthalophos, Standards, Toxicologic, Water.

The threshold organoleptic concentration of phthalophos (O,O-dimethyl-S-phthalimidomethylidithiophosphate) in water was established at 0.20 mg/l (manifest as aftertaste). The chronic nontoxic dose in cat (the most sensitive animal tested) is 0.32 mg/kg (6.4 mg/l). A maximum allowable concentration of 0.20 mg/l is recommended for phthalophos in water bodies.—Copyright 1971, Biological Abstracts, Inc. W72-03441

TOXICITY OF SOME INSECTICIDES TO THE INDIAN CATFISH, HETEROPNEUSTES FOSILIS (BLOCH), Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology-Entomology. P. K. Saxena, and Sushila Aggarwal.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

Anat Anz. 127 (5): 502-503. 1970.
Identifiers: Carbaryl, Cat-Fish, Contaminated, Endrin, Heteropneustes-Fssilis, Indian, Insecticides, Toxicity.

H. fossilis died within 5 hr in an aqueous solution of 20% commercial endrin (liquid)-a chlorinated hydrocarbon at 0.12 ppm concentration. At 0.0140 ppm concentration, the fish could survive only for 12-16 hr, while a concentration of 0.00598 ppm led to death within 24 hr. A further lowering of concentration to 0.00562 ppm allowed the fish to survive; the fish could sustain a concentration of up to 0.00578 ppm. Unlike endrin, the 50% commercial carbaryl (W.P.), a carbamate compound, was lethal at 50 ppm concentration; the fish died within 4 hr. Only 50% of the specimens could withstand a concentration of 40 ppm (sublethal). Body size had no relationship to mortality. Minor fluctuations in temperature did not influence the toxicity of these insecticides to the fish. Before death, the fish showed irritability, wild swimming and loss of equilibrium and great amounts of mucus and blackening of the skin were noticed. The endrin is about 70,000 times more toxic than the carbaryl. The minimum lethal ppm concentration of the insecticide is relevant in relationship to insecticide spraying.—Copyright 1971, Biological Abstracts, Inc.
W72-03451

THE TOXICITY OF CYANURATES FOR WARM-BLOODED ANIMALS,
A. P. Volkova, E. P. Izotova, N. F. Sokolova, and N. S. Lebedeva.
Tr Tsent Nauch-Issled Dezinfek Inst. 19. 140-145. 1970. Translated from Ref Zh Otd Vyp Farmakol Khimoter Sredstva Toksikol, 1970, No. 7.54.368.
Identifiers: Animals, Blooded, Cat, Cyanurates, Eye, Irritant, Membrane, Mouse, Mucous, Rabbit, Rat, Skin, Toxicity, Warm.

For 2-3 mo. mice received, instead of drinking water, freshly prepared solutions of the Na and K salts of dichloroisocyanuric acid, dichloroisocyanuric and trichloroisocyanuric acids, chlorinated slurry, the K salt of chlorinated slurry and chloramine. The amount of active Cl in the cyanurate solutions varied from 100 to 600 mg/l. The prolonged use of water disinfected with cyanurates did not exert any toxic actions, had no effect on reproductive functioning or the development of the progeny. In 30-day experiments on mice, rats, rabbits, and cats given 3 hr inhalations twice daily of atomized 0.05-2% solutions of these substances, all the cyanurates exerted weak local irritant action on the skin and to a considerable degree on the mucous membrane of the eye.—Copyright 1971, Biological Abstracts, Inc.
W72-03452

SAFETY EVALUATION OF A QUATERNARY AMMONIUM SANITIZER FOR TURKEY DRINKING WATER,
Salsbury Labs., Charles City, Iowa.
H. W. Reuber, T. A. Rude, and T. A. Jorgenson.
Avian Dis. 14 (2): 211-218. Illus. 1970.
Identifiers: Ammonium, Death, Distress, Drinking, Germex, Irritation, Mucosal, Oral, Quaternary, Respiratory, Safety, Sanitizer, Turkey.

A safety study was conducted with Germex, a 20% solution of n-alkyldimethylbenzylammonium chlorides with an alkyl distribution of C12 (lauryl), 5%; C14 (myristyl), 60%; C16 (palmityl), 30% and C8, C10, C18 (respectively caprylyl, capryl, stearyl), 5%. In a 6 wk experiment, levels up to 500 ppm active ingredient were given in the drinking water of growing turkey poults. The recommended use level is approximately 65 ppm. The highest no-effect dose was about 200 ppm, which did not depress growth significantly ($P > 0.05$). More than 200 ppm gave some evidence of irritating oral mucosa and causing clinical signs of respiratory distress. The highest level, 500 ppm, was not tolerated, causing 33% mortality between 6 and 17 days of medication. Death was preceded by the clinical syndrome of Germex toxicity. This syn-

drome is somewhat pathognomonic, with a reduction in water consumption being the primary sign.—Copyright 1971, Biological Abstracts, Inc.
W72-03453

VARIATIONS IN THE PERFORMANCE OF SHEEP WHEN INTRODUCED TO SALINE DRINKING WATER,
Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Div. of Plant Industry.
A. D. Wilson, and N. L. Hindley.
Csiro (Commonwealth Sci Ind Res Organ) Field Sta Rec. 9 (1): 45-53. Illus. 1970.
Identifiers: Drinking, Food, Intake, Performance, Saline, Sheep, Variations, Weight.

In two field experiments, gradual introduction (4 or 12 days) of sheep to an increasing concentration of dissolved salts in water to a maximum of 1.75% (1.45% NaCl + 0.3% MgSO₄) did not reduce the amount or the number of deaths, when compared to the immediate introduction of saline water. The deaths occurred when the full concentration of dissolved salts was introduced at times of high ambient temperature. Six sheep with large and 6 sheep with small bodyweight losses in the above experiments were placed in individual pens indoors. When the saline water was given, either to drink, or as a fixed volume administered by drenching, there were only small variations in food intake between sheep. However, when the sheep that had been drenched with the saline water were given the water to drink, the water and food intakes of some sheep were low. Food intakes were correlated with their weight changes in the field experiments. Variations in food intake of sheep on saline water, both between sheep and between experiments, are attributable to variations in the intake of the saline water.—Copyright 1971, Biological Abstracts, Inc.
W72-03454

THE EFFECTS OF OIL FIELD POLLUTANTS ON VEGETATION AND FARM ANIMALS,
Oklahoma State Univ., Stillwater. Coll. of Veterinary Medicine.
A. W. Monlux, R. J. Schoeppel, C. C. Pearson, and G. R. Waller.
J Amer Vet Med Ass. 158 (8): 1379-1390. Illus. 1971.
Identifiers: Animals, Farm, Field, Oil, Pollutants, Vegetation.

Disease problems in livestock exposed to oil field pollutants are not difficult to delineate. In the past, oil field production practices generally contaminated large surface areas; current methods allow for more efficient management by concentrating various oil field activities. Though the release of water containing moderately high concentrations of salt onto grazing lands adjacent to production causes spectacular damage to vegetation, the same water when ingested by livestock usually will not produce clinical disease. Ingestion of crude oil and lead frequently results in death. The origin of crude oil pollution is usually easily established, but difficulty may be encountered in finding an exact source of contamination by lead. Proper precautions can be taken to minimize the likelihood of all types of pollution.—Copyright 1971, Biological Abstracts, Inc.
W72-03455

AN ECOLOGICAL STUDY OF THE ALGAE OF THE RIVER MOOS I, HYDERABAD (INDIA) WITH SPECIAL REFERENCE TO WATER POLLUTION: IV. PERIODICITY OF SOME COMMON SPECIES OF ALGAE,
Osmania Univ., Hyderabad (India). Dept. of Botany.
V. Venkateswarlu.
Hydrobiologia. 35 (1): 45-64. Illus. 1970.
Identifiers: Algae, Blue-Green, Current, Diatoms, Ecological, Green, Hyderabad, India, Iron, Moosi, Nitrates, Oxygen, Periodicity, Pollution, River, Species, Temperature, Water.

Species favored by low temperature and high dissolved oxygen are: *Achnanthes minutissima* var. *cryptocephala* and *Cymbella microcephala*. Species favored by high temperature and high organic matter are: *Nitzschia obtusa* var. *scalpelliformis*, *Pinnularia biceps* var. *amphicephala*, *Merismopedia punctata*, and *Oscillatoria chalybea*. Species favored by low dissolved O₂ and high organic matter are: *Synedra ulna*, *Navicula rhynchocephala* var. *genuina*, *Pinnularia biceps* var. *amphicephala*, *Merismopedia punctata*, and *Oscillatoria chalybea*. *Gomphonema sphaerophorum* is favored by high dissolved O₂ and low organic matter. *Caloneis silicula* var. *truncatula* is favored by high temperature. Species favored by low temperature are: *Achnanthes exigua*, *Navicula pygmaea*, and *Nitzschia palea*. Species adversely affected by high temperature are: *Spirogyra* sp., *Stigeoclonium tenue*, and *Cyclotella meneghiniana*. Species adversely affected by fast current are: *Caloneis silicula* var. *truncatula*, *Spirogyra* sp. Species favored by high nitrate content are: *Achnanthes minutissima* var. *cryptocephala*, and *Cymbella microcephala*. Species showing an inverse relationship with nitrates are: *Cyclotella meneghiniana*, *Achnanthes microcephala*, *A. exigua*, *Navicula rhynchocephala* var. *genuina*, *N. pygmaea*, *Pinnularia biceps* var. *amphicephala*, *Nitzschia palea*, *Merismopedia punctata*, and *Oscillatoria chalybea*. Species exhibiting an inverse correlation with the water Fe content are: *Cyclotella meneghiniana*, *Achnanthes microcephala*, *Cymbella microcephala*, *Navicula pygmaea*, and *Nitzschia palea*.—Copyright 1971, Biological Abstracts, Inc.
W72-03456

THE EFFECT OF GERMANIUM DIOXIDE, A DIATOM - ELIMINATING CHEMICAL, ON THE GROWTH OF FREE-LIVING CONCHOCELIS OF PORPHYRA YEZOENSIS, (IN JAPANESE),
M. Kirita.
Bull Jap Soc Phycol. 18 (3): 167-170. Illus. 1970. English summary.
Identifiers: Chemical, Conchocelis, Di, Diatom, Eliminating, Free-Living, Germanium, Growth, Navicula, Oxide, Porphyra-Yezoensis.

Photosynthesis and growth of free-living Conchocelis of Porphyra as affected by GeO₂ was studied. The diatom-killing effect of the chemical was also observed. Algal growth was not affected by GeO₂ in the range of 1 approx. 20 ppm, but Conchocelis were killed after 20 days culture at more than 30 ppm. Diatoms (*Navicula* spp.) were completely killed after 30 days in the culture with the addition of GeO₂ in 1 approx. 20 ppm; 30 approx. 50 ppm killed diatoms earlier, after 20 days. Photosynthesis of free-living Conchocelis was not affected by GeO₂ in the range of 1 approx. 30 ppm, but appeared to be inhibited a little at 50 ppm.—Copyright 1971, Biological Abstracts, Inc.
W72-03460

A PROBABLE OCCURRENCE OF FISH MORTALITY IN RENUKOOT, RENUKOOT: DUE TO CHLORINE BEARING WASTES,
Central Public Health Engineering Research Inst., Kanpur (India).
H. C. Arora, S. N. Chattopadhyay, and V. P. Sharma.
Environ Health. 12 (3): 260-272. Illus. 1970.
Identifiers: Chlorine, Equalization, Fish, India, Mortality, Probable, Renukoot, Renukoot, Tank, Wastes.

Effluent disposal system in the light of fish mortality was studied. From the analysis of fluctuating data, pH value free residual chlorine and total solids were observed to be important parameters. It was desirable to install an equalization tank of suitable capacity so that the fluctuations were diminished and subsequently neutralized to keep the pH within permissible limits.—Copyright 1971, Biological Abstracts, Inc.
W72-03465

5D. Waste Treatment Processes

PRECIPITATION OF HEAVY METALS FROM NATURAL AND SYNTHETIC ACIDIC AQUEOUS SOLUTIONS DURING NEUTRALIZATION WITH LIMESTONE,

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05G.
W72-02956

CHANGES IN WATER QUALITY PARAMETERS OF RESERVOIRS DURING REGULATED FLOW CONDITIONS,

Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W72-02972

EFFECT OF SURFACTANT MICELLES ON METAL ION REMOVAL BY FLOTATION FROM METALLURGICAL WASTEWATER,

Missouri Univ., Rolla. Dept. of Chemistry; and Missouri Univ., Rolla. Dept. of Metallurgical Engineering.
R. L. Venable, and U. M. Oko.
Available from the National Technical Information Service as PB-205 423, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, Rolla, Nov 23, 1971, 113 p, 18 fig, 8 tab, 63 ref, 7 append. OWRR B-017-MO (1).

Descriptors: *Foam fractionation, Foam separation, Flotation, *Heavy metals, *Separation techniques, *Surfactants, Water purification, *Waste water treatment, Frothing, Electrolytes, Ions, Adsorption, Magnesium.

Identifiers: Ion flotation, Lead, Zinc, Surfactant micelles.

This study is a fundamental laboratory investigation of events occurring on a molecular scale that influence the process of ion flotation. To accomplish these objectives critical micelle concentrations and micellar molecular weights have been determined for sodium dodecyl sulfate in the presence of copper, lead, zinc, and magnesium and critical micelle concentrations have been determined with sodium and silver nitrate as the added electrolytes. The critical micelle concentrations in grams per liter are 1.30 with no added electrolyte, 2.10 with 9.66 x .0001 molar sodium and silver, 1.20 with 4.83 x .0001 molar copper, zinc, magnesium, and lead, and 0.65 with 9.66 x .0001 molar zinc. The micellar molecular weights are 14,200 without added electrolyte, 14,700 with 4.83 x .0001 molar copper, zinc, and magnesium, 18,100 with 4.83 x .0001 molar lead, and 25,500 with 9.66 x .0001 molar zinc. Flotation studies made by frothing for four hours and then analyzing the collapsed foam showed (1) that this surfactant is not at all selective among these divalent metal ions (2) increasing metal ion concentration resulted in more total metal removal but a lower percentage removal at any given surfactant concentration (3) formation of surfactant micelles reduced flotation efficiency markedly, and (4) precipitation would likely be a problem in practical application. It is postulated that the divalent metal ions adsorb the electrical double layer surrounding the micelles which renders them unavailable for adsorption at the surface of bubbles and reduces flotation efficiency.

W72-02973

REMOVAL OF NITRATE BY AN ALGAL SYSTEM,

California State Dept. of Water Resources, Fresno. San Joaquin District.
Randall L. Brown.

Copy available from GPO Sup Doc for \$1.25; microfiche from NTIS as PB-205 425, \$0.95. Environmental Protection Agency - Water Quality Office, Water Pollution Control Research Series, April, 1971, 132 p, 58 fig, 27 tab, 59 ref. EPA Program 13030 ELY.

Descriptors: Agricultural wastes, Water pollution control, *Biological treatment, *Nitrates, Treatment facilities, Algae, *Waste water treatment, *Algal control, *Aquatic weed control, California. Identifiers: *Algae stripping, Scenedesmus, Algal growth, Algal harvesting, *San Joaquin Valley (Calif).

An algal system consisting of algae growth, harvesting and disposal was evaluated as a possible means of removing nitrate-nitrogen from subsurface agricultural drainage in the San Joaquin Valley of California. The study of this assimilatory nitrogen removal process was initiated to determine optimum conditions for growth of the algal biomass, seasonal variations in assimilation rates, and methods of harvesting and disposal of the algal product. A secondary objective of the study was to obtain preliminary cost estimates and process design. The growth studies showed that about 75 to 90 percent of the 20 mg/l influent nitrogen was assimilated by shallow (12-inch culture depth) algal cultures receiving 2 to 3 mg/l additional iron and phosphorus and a mixture of 5 percent CO₂. Theoretical hydraulic detention times required for these assimilation rates varied from 5 to 16 days, depending on the time of the year. The total nitrogen removal by the algal system, assuming 95 percent removal of the algal cells, ranged from 70 to 85 percent of the influent nitrogen. The most economical and effective algal harvesting system tested was flocculation and sedimentation followed by filtration of the sediment. The algal cake from the vacuum filter, containing about 20 percent solids, was then air- or flash-dried to about 90 percent solids. The market value for this product as a protein supplement was estimated to be about \$80 to \$100 per ton. Minnesota State) W72-02975

PROTEIN AND ENERGY VALUE OF PEANUT HULL AND WOOD SHAVING POULTRY LITTERS,

Virginia Polytechnic Inst. and State Univ., Blacksburg.
Asok Nath Bhattacharya, and J. P. Fontenot.
Journal of Animal Science, Vol. 25, p 367-371, 1966, 5 tab, 20 ref.

Descriptors: *Feeds, *Peanuts, Diets, Animal metabolism, Digestion, *Farm wastes, Wood wastes, Proteins, Metabolism, Amino acids, *Waste disposal.

Identifiers: Total digestible nutrient, Digestive coefficients, Hulls, Shavings, Litter, Chemical composition, Feeding trials.

Three digestion and metabolism trials were conducted with 10 yearling wethers to study the protein and energy value of autoclaved peanut hull and wood shaving broiler litters, when each was incorporated at levels of 25 and 50% in a corn-hay basal ration. Apparent digestibility of crude protein was not significantly different among rations. Crude fiber digestibility of the litter rations was higher ($P < .01$) than that of the control ration. Dry matter, NFE and energy digestibility were lower ($P < .01$) when the litter level in the ration was increased from 25 to 50%. (Hazen-Iowa State) W72-03151

CONTROL OF GEOTRICHUM CANDIDUM IN BIOLOGICAL WASTE TREATMENT,

Rhode Island Univ., Kingston. Water Resources Center.

C. P. C. Poon, K. H. Bhayani, and K. K. Wang.
Available from the National Technical Information Service as PB-205 774, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report (1971). 26 p, 15 fig, 2 tab, 3 ref. OWRR A-033-R1 (2).

Descriptors: *Enzyme inhibitors, *Heavy metals, *Sewage bacteria, *Fungus, Temperature, Chloride, Asphalt, Photosensitization, Waste treatment, *Biological treatment, *Waste water treatment.

Identifiers: *Geotrichum candidum.

Enzyme inhibition of sewage microorganisms by heavy metals was studied. The degree of inhibition varied with metal and organism. The Michaelis-Menten model was used to show that zinc, trivalent chromium, and copper were more toxic to sewage bacteria, whereas silver and nickel were more toxic to sewage fungus *Geotrichum candidum*. A competitive inhibition was detected for sewage bacteria, but the same metals showed a mixed non-competitive inhibition for *Geotrichum candidum*. The results imply that silver and nickel could make *Geotrichum candidum* more competitive in sewage than bacteria. Other conditions under which *Geotrichum candidum* can grow better than sewage bacteria include low temperature, high chloride content and in the presence of asphalt photosensitization.

W72-03177

CARTRIDGE FILTRATION FOR IRON AND MANGANESE REMOVAL,

Rhode Island University, Kingston. Water Resources Center.
F. J. DeLuise.

Available from the National Technical Information Service as PB-205 776, \$3.00 in paper copy, \$0.95 in microfiche. Rhode Island Water Resources Center, Kingston, Completion Report (N.D.), 10 p, 5 fig. OWRR-A-029-R1 (1).

Descriptors: *Filtration, *Iron, *Manganese, Filters, Resistance, Waste water treatment, *Water treatment.

Identifiers: Specific resistance, *Cartridge filters.

A proposed continuous flow process for the removal of iron and manganese found in many water supplies has been investigated. The basic process consists of oxidation of the iron and manganese by sodium hypochlorite and subsequent removal of the oxidized particles through standard cartridge filter. Several variations in the basic process have been employed in an attempt to improve the filterability of the oxidized particles. Some characteristics of the resulting filter cake have been determined. Substantial improvement has been attained through the addition of body feed prior to filtration, but further improvement is necessary for the process to be truly practical.

W72-03179

ELECTROPHORETIC AND ELECTROCHEMICAL WATER PURIFICATION SYSTEMS,

Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.

W. M. Lyle, and E. A. Hiler.
Available from the National Technical Information Service as PB-205 804, \$3.00 in paper copy, \$0.95 in microfiche. Preprint, presented at the 1971 Winter Meeting American Society of Agricultural Engineers, Paper 71-704, Chicago, Ill., Dec. 7-10 1971. 21 p, 8 fig, 9 ref. OWRR-A-009-TEX (3).

Descriptors: *Waste water treatment, *Electrochemistry, *Electrophoresis, *Water purification, Model studies, *Electrical conductivity, Electrolysis, *Flocculation.

Identifiers: Electrochemical flocculation, Electrochemical disinfection.

Electrophoretic and electrochemical systems appear well adapted for removal of electrically charged pollutants and in addition have the potential of being entirely automated. Numerous design concepts were advanced and tested through the use of laboratory models. These included a parallel plate model which was designed entirely for electrophoretic removal, and porous filter and electrode grid models which incorporated both electrophoretic and electrochemical capabilities. Successful water clarification was attained with the parallel plate model only when the influent water was of very low electrical conductivity. Electrolysis products at high conductivities caused sufficient turbulence to completely disrupt electrophoretic transport. In addition, due to electrolysis, primary and secondary chemical reactions took place which altered the characteristics of the

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

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suspension. It was also concluded that the ease of automation with an electrophoretic system does not justify the high cost of water treatment by this method.
W72-03182

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W72-03196

INFILTRATION OF WASTE WATER INTO PEAT SOIL (JATEVESIEN SUOHONIMEYTYKSESTA),
For primary bibliographic entry see Field 05G.
W72-03238

PETROCHEMICAL EFFLUENTS TREATMENT PRACTICES, DETAILED REPORT,
Engineering-Science, Inc., Texas, Austin.
Earnest F. Gloyna, and Davis L. Ford.
Available from NTIS as PB-205 824, \$3.00 in paper copy, \$0.95 in microfiche. Water Pollution Control Research Series, Feb 70, 249 p, 31 fig, 46 tab, 301 ref, 2 append. FWPCA Program No 10200 02/70, Contract No 14-12-461.

Descriptors: *Oil, *Oil wastes, *Chemical wastes, Industrial wastes, Water analysis, Analytical techniques, Sampling, Organic matter, Toxicity, Phenols, Odor, Color, Turbidity, Biochemical oxygen demand, Hydrogen ion concentration, Organic loading, *Water reuse, Research and development, Waste identification, Algae, *Waste water treatment.

500 NEW PETROLEUM PRODUCTS ARE INTRODUCED ON THE MARKET EACH YEAR, MAKING THE PETROLEUM INDUSTRY AND ITS ALLIED PETROCHEMICAL INDUSTRIES SOME OF THE NATION'S FASTEST GROWING INDUSTRIES. The petrochemical industry is projected as increasing by 9% per year through 1975. Most of the pollutional load from petrochemical industries emanates from process waste streams. The processes for reducing its potential harm to the environment are well developed and understood. However, constant research and development efforts are continually introducing new pollutants into the environment. Therefore, development of new products should now include development of treatment schemes by which the wastes from the new products may be alleviated. Care must be exercised even in the sampling procedures, since many petroleum-based chemicals interfere with the accepted analytical test procedures. Finally, feasibility studies are needed to determine the capability of the petrochemical industries to re-use more of their wastewaters in the plant, and physical, chemical, and biological treatment are discussed. (See also W70-07511) (Lowry-Texas)
W72-03299

CHEMICAL-PHYSICAL WASTEWATER TREATMENT-PHASE I, THE LOW LIME PROCESS,
New York State Dept. of Environmental Conservation, Albany.
T. J. Tofflemire, and Leo J. Hetling.
Preprint, presented at the Water Pollution Control Federation Conference, 44th, Session 22, No. 4, October 7, 1971. 57 p, 23 fig, 14 tab, 58 ref.

Descriptors: *Coagulation, *Municipal wastes, *Industrial wastes, Pulp and paper industry, Colloids, Turbidity, Flocculation, Chemical precipitation, Hydrogen ion concentration, Lime, Alkalinity, Pilot plants, Reliability, Biological treatment, Activated carbon, Adsorption, Sludge, Dewatering, *Waste water treatment, New York.
Identifiers: *Chemical treatment.

Laboratory scale, pilot scale, and full scale tests were conducted in developing an economical physical-chemical treatment process for treatment plants treating less than 10 mgd. Jar tests were performed for coagulant selection and dosage determinations. Pilot plant and sludge dewatering studies on a larger scale to determine process workability and operating problems were also conducted. A low lime process, involving lime addition to pH 10.0, settling, recarbonation to pH 8.5, and dewatering and disposal of fresh sludge was developed and was shown to provide reliable treatment. Lime processes operating between pH 7.5 and 9.0 were less costly on a small scale but also less reliable. Processes using pH 11.0-12.0 operation provided higher removals but required recarbonation and recalcination, possibly economical for larger plants. The sludge mixture dewatered rapidly to 35% solids on drying beds, by vacuum filtration, and by centrifugation. Lime and polymer addition improved dewatering rates considerably. Either biological treatment or activated carbon units could follow the coagulation step to provide further treatment. (Lowry-Texas)
W72-03354

TASK FORCE APPROACH TO SOLVING A MERCURY PROBLEM IN THE CHLOR-ALKALI INDUSTRY,
Olin Corp., Stamford, Conn. Chemicals Div.
W. A. Oppold.
Preprint, presented at Water Pollution Control Federation Conference, 44th, Session 10, No. 2, October 5, 1971. 14 p.

Descriptors: *Heavy metals, *Toxicity, *Public health, Industrial wastes, Chlorine, Electrolysis, Cathode, Instrumentation, Monitoring, Water quality, *Waste water treatment.
Identifiers: *Mercury, *Task force, Caustic soda, Amalgam, Biomethylation.

A task force approach was used by the Olin Corporation in their drive to reduce pollution of the environment by inorganic mercury from their chlor-alkali plants. Mercury is used in an electrolysis cell in brine electrolysis to function as the cathode into which the electro-deposited sodium is dissolved to form an amalgam. The amalgam is separated from the brine, reacted with water to form sodium hydroxide and hydrogen, and the mercury is recycled. Small amounts of mercury salts are lost in the brine, in the caustic soda filter backwash water, hydrogen cooler condensate, etc. The task force assigned to the project included representation from: (1) engineering; (2) process engineering; (3) the Chlor-alkali technical center; (4) manufacturing; (5) research; (6) the instrument group; (7) medical; (8) legal; (9) environmental control and (10) management and public relations. Three additional consultants were hired. Long range plans were formulated to: (1) involve present plant personnel in reducing their own discharges; (2) determine those discharges which could be eliminated without major engineering changes and eliminate them; and (3) develop monitoring equipment and design modifications to maximize knowledge and control over discharges. In one years time, the task force accomplished all of its major objective, and all Olin Corporation plants were within acceptable discharge ranges. Research at Olin continues to enable Olin to keep up with new developments and stricter control. (Lowry-Texas)
W72-03356

ASPECTS OF HIGH-RATE BIOLOGICAL TREATMENT OF DOMESTIC AND INDUSTRIAL WASTEWATERS,
Water Pollution Research Lab., Stevenage, (England).
A. M. Bruce, and A. G. Boon.
Water Pollution Control, Vol 70, 1971, p 487-513, 8 fig, 4 tab, 48 ref.

Descriptors: *Waste water treatment, *Activated sludge, *Trickling filters, Biochemical oxygen demand, Efficiencies, *Biological treatment, *Industrial wastes.

Identifiers: Contact stabilization, Loading rates, Detention time, Effluent quality, *Domestic wastes.

In recent years, various investigations have been conducted at the Water Pollution Control Laboratory relating to high-rate biological treatment of sewage and of industrial effluents. Generally it was found that when wastewaters are treated at high rates the rate of BOD removed per unit capacity of treatment plant increases with increased loading, although the BOD of the effluent also increases and standards of purification cannot be maintained without employing two or more stages of treatment. A factor common to most high-rate biological processes is that nitrification occurs only partially, if at all. When a high degree of removal of ammonia is a prerequisite of the treatment process, it is usually necessary to apply conventional loadings or to employ more than one stage of treatment. The other stage of treatment may be biological, for example nitrifying filters, or a form of physicochemical process to remove ammonia, such as the systems recently developed elsewhere. Considerable discussion followed which dealt with the details of the data presented and definitions used. While the discussion amplified details, it did not add to the conclusions presented above. (Goessling-Texas)
W72-03359

A NEW DEVICE FOR WASTEWATER TREATMENT SLUDGE CONCENTRATION,
Ecodyne Corp., Lenexa, Kans. Smith and Loveless Div.
Brian L. Goodman, and Robert B. Higgins.
Water and Wastes Engineering, Vol 7, No. 8, August 1970, p 30-32, 3 fig.

Descriptors: *Separation techniques, *Sludge, *Dewatering, Activated sludge, Slurries, Pressure, Operation and maintenance, Cost analysis, *Waste water treatment.
Identifiers: *Solids-liquid separation, *Polymers, Primary sludge.

Sludge conditioning, gravity dewatering, and pressure dewatering have been combined in a new solids separation unit. The concentration consists of a sludge feed pump, polymer system, high rate sludge thickener, and a two stage dewatering unit. Several field trials of the unit, the S and L sludge concentrator, were conducted using primary, secondary, digested, and combined sludges. The major performance variables were shown to be sludge characteristics, sludge conditioning, solids and liquid unit loading levels, filter screens employed, filter screen rate of travel, and compression levels utilized. Feed solids concentration determined the performance of the thickener and the polymer dosage rate. Required polymer dosage varied between 5 and 15 pounds per ton of dry solids processed, and chemical costs ranged from \$5 to \$15 per ton of dry solids processed for the sludges used, with electrical costs of \$1.6 per hour of operation. The unit was shown to require only nominal operational and maintenance care. (Lowry-Texas)
W72-03360

ENVIRONMENTAL FACTORS CONSIDERED IN DESIGN OF PULP AND PAPER MILL,
United States Plywood-Champion Papers, Inc., Hamilton, Ohio.
Malcolm G. Lyon.
Water and Wastes Engineering/Industrial, Vol 7, No. 1, January 1970, p A/20-A/21, 1 fig, 2 tab.

Descriptors: *Pulp and paper industry, *Design criteria, *Environmental engineering, Industrial wastes, Sewage, Acidic water, Alkaline water, Sulfides, Oxidation lagoons, Aeration, Oxidation, Sludge disposal, Dewatering, Centrifugation, Incineration, Evaporation, Waste water treatment, Water quality control, *Treatment facilities.

Special design attention has been focused on mill process design, wastewater treatment, and gase-

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Ultimate Disposal of Wastes—Group 5E

ous effluent treatment for environmental protection in a new 500 ton/day pulp and paper mill near Courtland, Alabama. Direct digital computer control of Kamyr continuous pulping and bleaching processes as well as full analog control of critical process variables as a back-up is featured. Fiber and chemical losses from the process are minimized through the use of various screening, equalization, surfacing and curbing devices. The waste effluent treatment system was designed to achieve 85 plus % removal of dissolved and colloidal organic solids through bar screening, sedimentation, aeration, stabilization, and sludge dewatering and disposal. Wastes are segregated into sanitary wastes, neutral to alkaline wastes, acidic wastes, and emergency spills of strong chemicals, each flowing into a separate sewer system and receiving individual treatment. Gaseous effluent treatment includes electrostatic dust precipitation, mist scrubbing, a high-energy drop, venturi-type scrubber, dry dust collectors for all dry chemical bins, and a collector on the combination bark and auxiliary fuel boiler. (Lowry-Texas)
W72-03362

NEW ACTIVATED SLUDGE PLANT FOR KNOXVILLE, TENNESSEE,
Greeley and Hansen, Chicago, Ill.
Kenneth V. Hill.
Water and Waste Engineering, Vol 7, No. 1, January 1970, p 32-34, 4 fig, 7 tab.

Descriptors: *Waste water treatment, *Design criteria, *Activated sludge, Industrial wastes, Municipal wastes, Heavy metals, Sewers, Pumps, Construction costs, Operation and maintenance, Administration, Personnel, Tennessee.
Identifiers: Knoxville.

Annexation of 33,000 acres of surrounding territory required the City of Knoxville, Tennessee to expand its wastewater collection and treatment facilities. A \$2.6 million activated sludge plant was designed and constructed as part of a \$36 million construction project. This treatment plant was designed to serve an area of 222 sq. mi. within the present city limits. Influent to the plant is primarily municipal wastes, although some heavy metals are introduced from certain industries. Influent lines are sized for flows expected in 2010. Effluents are discharged by gravity to Fort Loudon Lake at lake levels below 812.0 ft. At 812.5 and above (approximately 60% of the time) effluent pumps are automatically activated. Start-up has been hindered by the fact that the plant was completed before the influent lines, and there has been little waste to treat. (Lowry-Texas)
W72-03363

POPULATION DESCRIPTION OF THE NON-METHANOGENIC PHASE OF ANAEROBIC DIGESTION-III. NON-HIERARCHICAL CLASSIFICATION OF ISOLATES BY PRINCIPAL COMPONENT ANALYSIS,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien.
Water Research, Vol 4, 1970, p 305-314, 2 fig, 2 tab, 12 ref.

Descriptors: *Waste water treatment, *Anaerobic digestion, *Anaerobic bacteria, Systematics, Bacteria.
Identifiers: Principal component analysis.

Identification of the numerically important non-methanogenic bacteria of anaerobic digestion have not been successful due to the disarray in the taxonomy of anaerobic bacteria. Classification through a hierarchical approach revealed that the agglomerative-polythetic classifications yielded groups of bacteria with homologous acid end-product patterns. A study to classify this bacterial population by principal component analysis has been undertaken. This approach yielded an ecologically important classification in that: (1) interrelationships between characteristics were revealed;

(2) these interrelations could be interpreted ecologically; (3) the interrelations showed marked similarity to those determined from agglomerative-polythetic classification; and, (4) a marked similarity existed between the classifications by means of agglomerative-polythetic procedures and by means of principal component analysis. (See also W72-03364) (Goessling-Texas)
W72-03365

FLUIDIZED BED RECOVERS PROCESS CHEMICALS,
Chicago Bridge and Iron Co., Plainfield, Ill.
John E. Hanway, Jr.
Water and Waste Engineering, Vol 7, No. 5, May 1970, p C/14-C/15, 1 fig.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Incineration, Oxidation, Evaporation, Air pollution, Efficiencies, Water pollution control, Waste water treatment, *Waste treatment.
Identifiers: *Chemical recovery.

In producing 270 tons of corrugating medium daily, the WesCor Corporation also generates 800 tons of waste liquor per day with an average solids concentration of 10%. This volume of liquid waste is treated by the Container-Copeland process which destroys 99% of the BOD and recovers 95% of the sodium sulfate and sodium carbonate. These chemicals are pelletized and sold to kraft pulp mills as salt cake make-up, or to glass making industries. Three-effect, forced-circulation Horton evaporators concentrate the liquid to 38% total solids. A pre-heater is used to pre-heat the fluidizing air and the reaction bed until equilibrium operation is established, after which the combustion is self sustaining. Ultimate reactor produce is a physical mixture of solid granules of Na₂SO₄ and Na₂CO₃, which are pelletized. Exhaust gases are scrubbed in a high efficiency wet scrubber using the weak liquor. On-stream factor of the system has averaged 95% since start-up in June 1967. (Lowry-Texas)
W72-03366

OZONE BIDS FOR TERTIARY TREATMENT,

Environmental Science and Technology, Vol 4, No. 11, November 1970, p 893-894, 1 fig.

Descriptors: *Ozone, *Oxidation, *Disinfection, Bacteria, Viruses, Organoleptic properties, Odors, Phenols, Amines, Biochemical oxygen demand, Municipal wastes, Industrial wastes, *Tertiary treatment, *Waste water treatment.
Identifiers: *On-site generation, *Sterilization.

Ozone's oxidative capacity is second only to that of chlorine, and recent developments in ozone generators have lowered the cost to where ozonation may be competitive with chlorination in some instances. In generating ozone, oxygen or air is passed between two electrodes to which a high voltage alternating current is applied. In large installations using pure oxygen, ozone, concentrations of 2% in the oxygen stream are attained at a cost of 6-8 cents per pound of ozone generated. On-site generation of ozone eliminates the hazard of transporting and handling large amounts of chlorine. In addition, ozone destroys both bacteria and viruses, whereas chlorine is ineffective against viruses. Ozone is also more effective against the major taste and odor causing compounds in raw water, namely phenols and amines. Ozone is capable of higher reductions of biochemical oxygen demand and total organic carbon than carbon polishing and is fully cost competitive. Several installations treating both industrial and municipal wastes are currently functioning. Despite these advantages, ozonation is looked upon with disfavor due to a bad image developed years ago before many refinements were made. Because of the small size of the industries producing ozonators, a high level promotion of ozonation is unlikely in the near future. (Lowry-Texas)
W72-03368

HIGH-RATE ANAEROBIC SLUDGE DIGESTERS PROVE ECONOMICAL, EASY TO OPERATE, IN NEW JERSEY SEWER PLANT,
Bergen County Sewer Authority, Little Ferry, N.J.

H. R. Zablatzky.
Water and Wastes Engineering, Vol 7, No. 2, February 1970, p 43-44, 2 fig, 1 tab, 7 ref.

Descriptors: *Waste water treatment, *Sludge digestion, *Anaerobic digestion, Sludge disposal, Hydrogen ion concentration, Alkalinity, Data collection, Economic justification, Treatment facilities, New Jersey.
Identifiers: Gas recirculation, Volatile acid concentration.

Determined to effectively serve nearly a half-million people, and to cut capital costs, the Bergen County Sewer Authority has expanded its system, increasing the amounts of solids handled. Originally built as a 20 MGD secondary treatment plant with land disposal of digested sludge, the plant has been expanded to 50 MGD with sludge concentration units, high rate sludge digestion and marine disposal of digested sludge. Studies and tests of high rate digestion have been underway for some years and continue even today. Original tests were started in 1954 but after a few years were abandoned due to poor results and the necessity for extensive repairs. In 1960, the conventional sludge digestion units were converted to high rate digesters utilizing thickened sludge, PFT multi-point gas recirculation and digestion of primary skimmings. The results of operation during 1968 are presented to show the effectiveness of the process. When kept on steady state conditions, the process works well and without difficulty. Recycling of digester sludge to the thickening tank* to reduce solids disposal costs has been practiced since 1968. Because of the ease of operation, and the possibility of varying the number of digesters in service, it appears that the digesters are loafing. (Goessling-Texas)
W72-03369

WE ARE NOT RUNNING OUT OF WATER,

For primary bibliographic entry see Field 06D.
W72-03370

5E. Ultimate Disposal of Wastes

DISPOSAL OF MERCURY WASTES FROM WATER LABORATORIES,
Environmental Protection Agency, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W72-03149

PROTEIN AND ENERGY VALUE OF PEANUT HULL AND WOOD SHAVING POULTRY LITTERS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 05D.
W72-03151

NUMERICAL TECHNIQUES APPLIED TO PARTICLE DEPOSITION DURING SLOT FLOW,
Arkansas Univ., Fayetteville. Water Resources Research Center.
For primary bibliographic entry see Field 02J.
W72-03154

THE DILUTION OF AN UNDERSEA SEWAGE CLOUD BY SALT FINGERS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-03170

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal of Wastes

HYDROGEOLOGIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL, WITH A CASE STUDY IN SOUTHEASTERN WISCONSIN.
Wisconsin Univ., Madison. Water Resources Center.

M. J. Ketelle.

Available from the National Technical Information Service as PB-205 951, \$3.00 in paper copy, \$0.95 in microfiche. In: Technical Record, Vol. 3, No. 3, Southeastern Wisconsin Regional Planning Commission, September 1971. 39 p, 3 fig, 3 tab, 41 ref, 2 append, 9 maps. OWRR-A-018-WIS (2).

Descriptors: *Liquid wastes, *Water pollution control, *Soil disposal fields, *Waste water disposal, Hydrogeology, Hydrologic properties, *Groundwater movement, Soil properties, Climates, Groundwater, Wisconsin, *Waste disposal. **Identifiers:** Groundwater contamination, Geologic properties, Geography, Southeastern Wisconsin.

Geologic and hydrologic parameters which relate to groundwater contamination are discussed. Geologic factors include nature of soils, unconsolidated materials, and consolidated sediments. Hydrologic factors are infiltration, permeability, flow in the unsaturated and saturated zones, and attenuation through mixing. Physical conditions required for liquid waste disposal are discussed; geologic considerations (nature of earth materials and structural features), hydrologic considerations (water-table depth and relation to flow systems), surface conditions (topography, cover crop, climate, and acreage), cultural considerations (distance to buildings, wells, streams, and man-induced changes in the land), and long-range effects on the soil. A case-study of feasibility of liquid waste disposal for the seven county region of southeastern Wisconsin is described. The geography, climate, geology, soils, and groundwater of the area are discussed. Maps of physiographic features, surficial deposits, drift thickness, bedrock geology, and soils are shown. From these sources a final map of the region is developed based on eight categories ranging from areas least suitable for liquid waste disposal to those most suitable. (Ketelle-Wisconsin)
W72-03181

5F. Water Treatment and Quality Alteration

METHOD FOR SIMULTANEOUS CLARIFICATION AND DISINFECTION OF SURFACE WATERS IN THE FIELD.

Voenn-Meditsinskaya Akademiya, Leningrad (USSR).

N. N. Alfimov, Z. M. Evenshtein, and N. N. Rudenko.

Gig Sanit. 35 (6): 86-88. 1970.

Descriptors: *Water treatment.

Identifiers: Clarification, *Disinfection, Field, Method, Surface.

Aluminum hydroxychloride, $Al_2(OH)_5Cl$, used in amounts of 6.9 mg/l (based on elemental aluminum) at 12-20°C with a contact time of 15 min., and followed by carbon filtration, was a very effective water clarifying and disinfecting agent. Water thus treated was found to contain 5.1 mg/l aluminum hydroxychloride (based on elemental aluminum) and is regarded safe for human consumption; thus this method is promising for use under field conditions.—Copyright 1971, Biological Abstracts, Inc.
W72-03032

CAUCASIAN MINERAL WATER AND PREVENTION OF DENTAL CARIES.
Central Research Inst. for Health Resort Therapy and Physiotherapy, Moscow (USSR).

V. P. Scherbak.

Gig Sanit. 35 (6): 86. 1970.

Identifiers: *Caries, Caucasian, *Dental, Mineral, Prevention.

In areas where local waters contain only 0.2 mg of F/l, mineral water containing at least 1 mg/l (Such as Caucasian Mineral Water) should be used for drinking as prophylaxis against dental caries. Bottle labels should indicate the F content of the water.—Copyright 1971, Biological Abstracts, Inc.
W72-03034

EFFECT ON BORON IN DRINKING WATER ON THE SECRETORY-ENZYMIC ACTIVITY OF THE GASTROINTESTINAL TRACT OF DOGS.

Institute of General and Municipal Hygiene, Moscow (USSR).

T. S. Khachatryan.

Gig Sanit. 36 (1): 11-15. Illus. 1971. (Engl. summ.).

Identifiers: *Boron, Dogs, *Drinking, Entero, Enzymic, Gastro, Inhibition, Intestinal, Kinase, Secretory, Tract.

Addition of Bo to water in concentrations above 2-3 mg/l brought about certain disturbances in food digestion. The amount of gastric juice secreted, and its free and total acidity were decreased. Enterokinase was inhibited in the intestinal juice and feces.—Copyright 1971, Biological Abstracts, Inc.
W72-03039

REMOVAL OF RADIONUCLIDES FROM THE PASCO SUPPLY BY CONVENTIONAL TREATMENT.

General Electric Co., Richland, Wash.

R. L. Jenkins.

Journal of the American Water Works Association, Vol. 52, No. 7, p 834-840, July 1960. 8 figs.

Descriptors: *Water treatment, *Radioactive wastes, *Nuclear reactor, Coagulation, Sedimentation, Filtration, Ion exchange, Washington. **Identifiers:** Pasco (Wash).

More than 60 radionuclides have been measured in Hanford Atomic Products Operation (HAPO) reactor effluent, and the concentrations of 27 of them are measured routinely. The concentrations of these produced in the Pasco River are only small fractions of the maximum permissible counts (MPC) allowable. The facilities of the Pasco plant were not designed and are not operated with deliberate effort to remove radionuclides. However, the water plant does not remove large fractions of the radionuclides; chart indicates reduction of total from about 14 per cent of MPC to near 4 per cent of MPC, equal to about 70 per cent removal. (Bean-AWWA)
W72-03175

CARTRIDGE FILTRATION FOR IRON AND MANGANESE REMOVAL.

Rhode Island University, Kingston. Water Resources Center.

For primary bibliographic entry see Field 05D.

W72-03179

ELECTROPHORETIC AND ELECTROCHEMICAL WATER PURIFICATION SYSTEMS.

Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D.

W72-03182

ALGAL REMOVAL BY ALUM COAGULATION.

Illinois State Water Survey, Urbana.

S. D. Lin, R. L. Evans, and D. B. Beuscher.

Report of Investigation 68, 1971. 20 p. 2 fig, 5 tab, 30 ref, append A, B.

Descriptors: *Algal control, *Water quality control, *Coagulation, *Water treatment, Illinois, Rivers, Chemical analysis, Flocculation, Turbidity, Scenedesmus, Euglena, Mathematical studies, Hydrogen ion concentration, Alkalinity, Aluminum, Cyanophyta, Chlorella, Sedimentation, Sanitary engineering, Ankistrodesmus, Navicula. **Identifiers:** *Alum, Illinois River (Ill).

An investigation of algal removal by alum coagulation, flocculation, and sedimentation was designed to define the possible relationships between coagulant dosage and other readily measurable factors. Water samples from the Illinois River were used with a laboratory jar test apparatus to determine whether algal removal is a function of genera, whether coagulant dosage is the same for optimum turbidity removal as for optimum algal removal, whether algal removal efficiencies can be related to water temperature, pH, alkalinity, turbidity, residues, coagulant dosage, and other variables. Twenty-five samples were subjected to the coagulation process using alum dosages. At a coagulant concentration of 30 mg/l most of the troublesome algae were removed and an overall algal reduction in excess of 85% was achieved. Spine-like algae, such as Scenedesmus and Ankistrodesmus, the boat-shaped Navicula, and the filamentous free-floating Aphanizomenon, required higher alum doses for removal; the most persistent organism was Euglena. A quadratic expression described mathematically the relationships between algal or turbidity removal and alum dosage. The most important factors were alum dosage, initial algal concentration, and shape and size of the genera encountered. (Jones-Wisconsin)
W72-03214

A NEW TYPE OF DISINFECTANT FOR WATER SUPPLIES.

Kansas State Univ., Manhattan. Dept. of Chemistry.

J. L. Lambert, and L. R. Fina.

Available from NTIS, as PB-205 823, \$3.00 in paper copy, \$0.95 in microfiche. Kansas Water Resources Research Inst., Manhattan. Contribution No. 78, 1971. 15 p, 3 tab, 12 ref. OWRR-A-028-KAN (2).

Descriptors: *Water treatment, *Disinfection, Anion exchange, Viruses, Bacteria.

Identifiers: *Bacilli, *Triiodide, Cadmium iodide-linear starch reagent.

Triiodide combined with strong base anion exchange resins forms stable, nearly insoluble, complexes that have remarkable disinfecting capabilities. Complete kills are effected with water suspensions of virus (both DNA and RNA) and Gram negative and Gram positive bacteria (whether capsulated or not), and viability of sporulating Bacilli species is reduced up to 99.9%. Water to be treated is simply passed through a column of the resin-complex. The bacteria or virus, shown by 14C or 3H tracers, pass through the column and are not filtered out. Kill is immediate and irreversible. No 12, 13-, 10-, 103-, and 104- are detected when the cadmium iodide-linear starch reagent method was used. Iodide, the halide form, was found in amounts ranging from 0.2-0.5 PPM. This is well below the taste threshold and indeed may be considered beneficial in iodine deficient areas. (McKenna-Kansas)
W72-03298

HEALTH PHYSICS ASPECTS OF LRL TRITIUM RELEASE.

Lawrence Radiation Lab. California Univ., Livermore.

For primary bibliographic entry see Field 05C.

W72-03311

RADIOLOGICAL SIGNIFICANCE OF 100-N SANITARY WATER.

Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.

W. L. Fisher.

Available from the National Technical Information Service as BNWL-B-63. \$3.00 per copy, \$0.95 microfiche. Report BNWL-B-63, March 1971, 21 p.

Descriptors: *Nuclear powerplants, *Effluents, Water pollution, *Water pollution sources, *Water pollution effects, Damages, Potable water, Measurement, Monitoring, Radioisotopes.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Treatment and Quality Alteration—Group 5F

Identifiers: Dose measurement, GI tract, Dosimetry, Radiation exposure, Ingestion, Radiation damage.

Since the startup of 'N' reactor in 1963, sanitary water supplied by the 100-N water treatment plant has been used by 100-N and WPPSS personnel for drinking and other purposes. Because the raw water is taken from the Columbia River not far downstream from an operating production reactor, it contains some radioactivity. While processing the raw to sanitary water removes much of the radioactivity, some remains to contribute slightly to the radiation exposure of those drinking it. Various methods have been compared for estimating GI Tract dose from radionuclides in drinking water. Estimates based on 'total beta' measurements appear to be more accurate than those based on the measured concentration of a single radionuclide. A recommended method of making 'total beta' dose estimates is described. (Houser-ORNL)

W72-03313

PREVENTING IRON DEPOSITION WITH SODIUM SILICATE,

Ontario Water Resources Commission, Toronto. F. J. Dart, and P. D. Foley. Journal of the American Water Works Association, Vol 62, No. 10, October 1, 1970, p 663-668, 4 fig, 8 ref.

Descriptors: *Water treatment, *Groundwater, *Iron compounds, *Deposition, Flocculation, Silicates, Laboratory tests, On-site tests, Analytical techniques.

Identifiers: Red water, Chelation, *Ontario (Canada).

Due to the large number of well water supplies in Ontario requiring deposition control of iron and manganese, considerable effort by the Ontario Water Resources Commission has been required to resolve the problems. Unfortunately there is not a simple standard method for iron removal that can be applied across the board. A search of the literature revealed that waters containing high concentrations of silicates apparently did not support an iron problem even though the concentrations of iron were high. A study was conducted to determine if the addition of silica would assist in reducing the deposition of iron in water supplies. These tests were followed by full scale tests of municipal water supplies. It was found that the addition of small amounts of silicate would sequester the iron in the water and prevent deposition. Generally, the addition should take place near the point at which the iron is oxidized to the ferric iron. This treatment is more favorable where the water is not hard, has a naturally high silica content and has a higher pH reaction to the treatment addition (over 7.5). Theoretically it appears that the mechanism of iron control with sodium silicate depends upon the chelation of the ferric ion by the ortho-silicate anion. There is much work to be done to fully understand this process, but it does appear to offer the promise of an economic method or iron deposition control. (Goessling-Texas)

W72-03371

STATUS OF FLUORIDATION IN THE UNITED STATES AND CANADA.

American Water Works Association, New York. Task Group 2620P.

Journal of the American Water Works Association, Vol 52, No 12, p 1513-1520, December 1960. 4 fig, 7 tab, 2 ref.

Descriptors: *Water treatment, *Fluoridation, *Fluorides, Water supply, Public health.

At the end of 1959, 118,000,000 people were served by public water supplies in the U.S. Approximately 7 million were served water naturally containing at least 0.7 ppm of fluoride. Another 36 million received water supplemented by fluoride

to at least 0.7 ppm content. 81 communities adopted fluoridation during 1959. 35 percent of all cities of population over 10,000 have adopted fluoridation, but only 4.5 percent of those under 10,000 have adopted it. In Canada, 22 new supplies, serving 125,000 people, started fluoridation in 1959. Sodium silicofluoride continues to be the most popular chemical, being used in supplies for more than 21 million people. Sodium fluoride continues to be the choice of smallest supplies. Fluosilicic acid was used in supplies for about 10 million people. All compounds were reported in plentiful supply. (Bean-AWWA)

W72-03401

EFFECT OF FISH POISONS ON WATER SUPPLIES, PART 1 - REMOVAL OF TOXIC MATERIALS,

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

J. M. Cohen, L. J. Kamphake, A. E. Lemke, C. Henderson, and R. L. Woodward.

Journal of the American Water Works Association, Vol 52, No 12, p 1551-1566, December 1960. 7 fig, 7 tab, 25 ref.

Descriptors: *Water treatment, *Fish control agents, *Toxicity, *Odor, *Coagulation, *Chlorination, *Activated carbon, Pesticides, Rotenone, Piscicides.

Identifiers: *Chlorine dioxide, Toxaphene.

Although both rotenone and toxaphene are relatively toxic, their occasional use for fish management should present no hazard if adequate measures are taken for their removal by treatment, or by decomposition through natural processes. Alum coagulation is completely ineffective in removal of fish poisons. Chlorination is ineffective on fish poison formulations except that chlorine and chlorine dioxide are effective against rotenone and rotenoid compounds. However, means must be provided to remove the substantial amount of residual chlorine. Activated carbon will remove rotenone and toxaphene poisons, also the solvents and emulsifiers present in all the commercial formulations, thereby eliminating odors. (Bean-AWWA)

W72-03410

INCREASED FLUORIDE INGESTION BY BOTTLE-FED INFANTS AND ITS EFFECT,

Karolinska Institutet, Stockholm (Sweden). Y. Ericsson, and U. Ribelius.

Acta Paediatr Scand. 59 (4): 424-426. 1970. **Identifiers:** Bottle, Breast, Cow, Enamel, Fed, Feeding, Fluoride, Hazard, Health, Infants, Ingestion, Milk, Mottling, Powdered, Sweden, Uppsala.

Infant feeding with water-diluted cow's milk or dry-milk formulas supplies much greater fluoride than breast-feeding, even with low water fluoride content. An investigation of schoolchildren in Uppsala, Sweden (1.2 ppm F in the drinking water) showed only an insignificant trend towards increased enamel mottling in typically formula-fed children compared to breast-fed children. No health hazard thus seems to be involved.—Copyright 1971, Biological Abstracts, Inc.

W72-03426

DERMATOPHYTES AND OTHER KERATINOLYTIC FUNGI IN SURFACE AND WASTE WATERS,

Palacky Univ., Olomouc (Czechoslovakia). Faculty of Medicine.

For primary bibliographic entry see Field 05A.

W72-03435

DEATH CASES IN NEWBORNS CAUSED BY PSEUDOMONAS AERUGINOSA CONTAMINATED DRINKING WATER,

Vienna Univ. (Austria). Hygiene Inst. For primary bibliographic entry see Field 05C.

W72-03436

METHODS OF CHARACTERIZING MISSOURI RIVER ORGANIC MATERIALS OF TASTE AND ODOR INTEREST,

Washington Univ., St. Louis, Mo. D. W. Ryckman, N. C. Burbank, and E. Edgerley.

Journal of the American Water Works Association, Vol. 53, No. 11, p.1392 - 1402, November 1960. 7 figs, 4 tabs, 6 refs.

Descriptors: *Water treatment, *Organic matter, *Taste, *Odor, *Biodegradation, Activated carbon, spectroscopy.

Identifiers: Carbon filters, C.C.E.

Carbon filters were installed on raw water and tap water at 8 locations along the 800 mile reach of the Missouri River. 127-cu in. carbon filters were used, filtering 5,000 gallons of water in a 2-week period. Chloroform was used as solvent and the material was divided into groups: ether insolubles, water solubles, amines, strong acids, weak acids, and neutrals. Threshold odor tests utilized. Results of CCE (Concentrated Carbon Chloroform extract) times flow rates showed an increase in total organics in the river in pounds per day of four times during passage from Yankton to St. Louis. The odor potential of these organics increased markedly at downstream stations, requiring only one-third as great a concentration to produce a given odor. Water treatment is not removing significant quantities of organics of taste and odor significance in eight plants from Yankton to St. Louis. Infrared spectroscopy is useful in proving other methods of characterization. Characterization through the use of biological degradation studies is important in determining the persistence of organic material having taste and odor significance. (Bean-AWWA)

W72-03439

MINERALS IN THE MUNICIPAL WATER AND ATHEROSCLEROTIC HEART DISEASE,

North Carolina Univ., Chapel Hill. School of Public Health.

A. W. Voors.

Amer J Epidemiol. 93 (4): 259-266. 1971.

Identifiers: Athero, Calcium, Chromium, Death, Heart, Human, Lithium, Magnesium, Minerals, Municipal, Sclerotic, Vanadium, Zinc.

A search was made for the active principle in hard drinking water accounting for its often observed negative correlation with atherosclerotic heart disease (AHD). Although conceivably mineral elements can cause AHD either through oversupply (toxicity) or through under supply (deficiency), only potentially deficient minerals were considered. In the current biological literature, deficiencies of 6 metals were implicated as possible causes of AHD: Ca, Cr, Li, Mg, V and Zn. Each of these 6 metals was considered separately, while keeping the others constant, one at a time, and the appropriate product-moment partial correlation coefficients were tested against the null-hypothesis. This was done consecutively for each race and sex, using secondary data from 99 of USA largest cities. Only Li levels are significantly negatively correlated with AHD in whites, and likewise V levels in non-whites. These results are likely to be consistent for both sexes. This finding supports the desirability of further research towards mineral enrichment of the drinking water in certain communities, provided that conclusive evidence of the harmlessness of such enrichment is obtained.—Copyright 1971, Biological Abstracts, Inc.

W72-03442

SAFETY EVALUATION OF A QUATERNARY AMMONIUM SANITIZER FOR TURKEY DRINKING WATER,

Salsbury Labs., Charles City, Iowa. For primary bibliographic entry see Field 05C.

W72-03453

TURBIDIMETRIC CONTROL OF FILTER EFFLUENT QUALITY,

Iowa State Univ., Ames.

J. L. Cleasby.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

Journal of the American Water Works Association, Vol. 52, No. 11, p 1411-1415, November 1960. 1 fig, 1 ref.

Descriptors: *Water treatment, *Turbidity, *Control, *Instrumentation, *Filtration, *Water quality, Water supply.

Turbidity is a very indefinite quality to measure. Many problems prevent the accurate determination of an absolute turbidity level for any sample of water. The new low-range turbidimeter (Hack) which provides an accurate, continuous record of turbidity is a welcome addition to plant control instrumentation. Turbidity measurement is the best means of continuous control of filter effluent quality. Important uses for the new turbidimeter are: selection of proper time to backwash filters, study of feasibility of high filtration rates, and observations of effect of plant operational practices on effluent water quality. (Bean-AWWA) W72-03458

WATER DISINFECTION PRACTICES IN THE UNITED STATES,

Chlorine Inst., New York.

E. J. Laubusch.

Journal of the American Water Works Association, Vol. 52, No. 11, p 1416-1426, November 1960. 6 tab, 11 ref.

Descriptors: *Water treatment, *Disinfection, *Standards, *Chlorination, Water supply. Identifiers: Ten-State Standards.

Except for waters used on interstate carriers, authority for control of public supplies is vested in the States. The degree of control varies considerably, though USPHS Standards of quality invariably serve as minimum index of bacteriologic safety. A total of 30 states publish minimum standards for water plant design and operation. Sixteen have adopted the Ten-State Standards as the basis of minimum requirements. Not all states require disinfection of all supplies, but at least 30 recommend chlorine disinfection of surface waters. Twelve others specify chlorination as needed to comply with Standards (USPHS). Only a few states have fixed policies as to points of chlorination, contact periods on minimum standards do provide for standby equipment. (Bean-AWWA) W72-03462

SIGNIFICANCE AND REMOVAL OF MANGANESE IN WATER SUPPLIES,

American Water Works Association, New York. Task Group 2680P.

A. E. Griffin.

Journal of the American Water Works Association, Vol. 52, No. 10, p 1326-1334, October 1960. 1 fig, 1 tab, 11 refs.

Descriptors: *Water treatment, *Manganese, *Distribution systems, *Oxidation, *Filtration, *Phosphates, *Aeration, *Chlorination, *Lime, *Chlorine, *Copper, *Zeolites. Identifiers: Chlorine dioxide, Potassium permanganate.

Manganese is a common ingredient of impounded waters and many well supplies. It is common in river waters, especially those receiving mine waters. Content exceeding about 0.02 ppm will cause problems in distribution systems, where it may be precipitated after oxidation or be concentrated in certain organisms. Manganese may be removed on filters if oxidized before entrance or it may be removed by the manganese zeolite process. It may be stabilized in the distribution system by application of about 2 ppm of sodium metaphosphate at the plant effluent. Various oxidation processes are discussed and applications cited. These are aeration, chlorination, chlorine plus copper, chlorine dioxide, lime to high pH, and application of potassium permanganate. (Bean-AWWA) W72-03463

MICROBIAL CONCENTRATION OF IRON AND MANGANESE IN WATER WITH LOW CONCENTRATIONS OF THESE ELEMENTS,

Illinois Univ., Urbana.

R. S. Wolfe.

Journal of the American Water Works Association, Vol. 52, No. 10, p 1335-1337, October 1960. 1 fig, 2 tab, 6 ref. PHS Grant 6430.

Descriptors: *Water treatment, *Microbiology, *Iron, *Manganese, Bacteria, Water supply.

A large ensheathed bacterium has been studied that concentrates iron and manganese in its sheaths and that flourishes in a water supply containing, by ordinary chemical analysis, no detectable manganese and less than 0.02 ppm of iron. This is a large hairlike bacterium which produces clumps which are dark gray-brown and are flocculent when suspended in water. Analysis of a dried weight of the bacteria showed Mn 02 = 12.00 percent, Fe 203 = 9.80 percent. (Bean-AWWA) W72-03464

EFFECTS OF PHOSPHATES ON COAGULATION AND SEDIMENTATION OF TURBID WATERS,

Illinois Univ., Urbana.

J. J. Morgan, and R. S. Engelbrecht.

Journal of the American Water Works Association, Vol. 52, No. 10, p 1303-1314, October 1960. 4 figs, 7 tabs, 14 refs.

Descriptors: *Water treatment, *Phosphates, *Coagulation, *Sedimentation, *Turbidity, Iron compounds, Detergents. Identifiers: Aluminum sulfate, Ferric sulfate, Ferric chloride.

Different sources of water were used to test the effects of the condensed phosphates, sodium tripolyphosphate (STP) and tetra-sodium pyrophosphate (TSPP), the most important builders in detergents. Alum, ferric sulfate, and ferric chloride were utilized as coagulants. Alum and iron salts appear to have approximately the same effectiveness. STP and TSPP in relatively high concentrations are capable of interfering with the coagulation and sedimentation of hard, turbid waters; the effects appearing to equal. The magnitude of interference is reduced by reasonable increases in coagulant dosage, improvement in mixing, and flocculation characteristics. Orthophosphate compounds, such as monosodium orthophosphate, produced no interference with normal coagulation and sedimentation. (Bean-AWWA) W72-03472

INNOVATIONS IN WATER CLARIFICATION,

General Electric Co., Richland, Wash.

W. R. Conley, and R. W. Pitman.

Journal of the American Water Works Association, Vol. 52, No. 10, p 1319-1325, October 1960. 3 tab, 3 ref.

Descriptors: *Water treatment, *Filtration, *Flocculation, *Sedimentation, *Electrolytes, Head loss. Identifiers: *Dual media filters.

Experimental filter operation over 4 years has achieved improved chemical treatment and filters, demonstrating practical filtration with a flocculation time as short as 10 min, a settling time as short as 60 min, and a filtration rate as high as 10 gpm/sq. ft. The chemical treatment uses 5-50 ppb of organic polyelectrolytes to control filter breakthrough. Used in conjunction with filters composed of both 0.4 mm sand and 0.7-1.5 mm anthracite, it is possible to filter water at high rates without excessive head loss, and produce exceptionally clear filtered water. (Bean-AWWA) W72-03473

LOW-TEMPERATURE LIQUID LIME SLAKING AT HOWARD BEND TREATMENT PLANT,

St. Louis Dept. of Water, Chesterfield, Mo.

W. B. Schworm.

Journal of the American Water Works Association, Vol. 52, No. 9, p 1189-1194, Sept 1960. 3 fig, 3 tab, 3 ref.

Descriptors: *Water treatment, *Lime, Missouri, Calcium carbonate. Identifiers: Howard Bend Plant, *Lime slaking.

Temperatures of 180F or greater were common in lime slaking, a period of 30 min being generally provided; about 3.5 lb. of water being required for each 1 lb. of lime. Tests were made to determine whether lime could be efficiently slaked at lower temperatures, without heating but with temperature controlled by the rate of flow of tap water. Heat should be provided during start-up to 140F. Temperature was maintained by flow-rate control. With the fast-slaking, rotary-burned lime used in the tests slaking was accomplished at lower temperatures. (Bean-AWWA) W72-03474

TASTE AND ODOR PROBLEMS IN NEW RESERVOIRS IN WOODED AREAS,

Seattle Dept. of Water, Wash.

E. J. Allen.

Journal of the American Water Works Association, Vol. 52, No. 8, p 1027-1032, August 1960. 1 fig, 8 ref.

Descriptors: *Water treatment, *Taste, *Odor, *Reservoirs, *Deciduous trees, *Decomposing organic matter, *Algae, *Phenols.

The nearly universal appearance of taste and odors in reservoirs due to many different causes, are discussed which include decaying vegetation originally present on the site, deciduous trees adjacent to the reservoirs with decay of fallen leaves, algae fed by the leaf infusions, phenols produced by decaying leaves, (beavers) building dams and dragging vegetable materials into the reservoir, weed decay, water collecting in road ditches providing environment for algae growths. Taste and odor problems in new reservoirs in wooded areas can be avoided by recognition of the environmental conditions conducive to their production and by taking the proper measures to eliminate such conditions. (Bean-AWWA) W72-03475

ORGANIC FOULING OF ANION-EXCHANGE RESINS,

Rohn and Haas Co., Philadelphia, Pa.

N. W. Frisch, and R. Kunin.

Journal of the American Water Works Association, Vol. 52, No. 7, p 875-887, July 1960. 11 fig, 3 tab, 11 ref.

Descriptors: *Water treatment, *Organic acids, *Fouling, *Ion exchange, *Resins, *Oxidation, Sodium compounds. Identifiers: Sodium chloride, Sodium hypochlorite.

Fouling of anion-exchange resins is caused by the exchange of large organic acids, the humic acids produced by decay of vegetable matter, which are commonly found in surface waters. Accumulation on the resins limits their capacity for exchange and eventually the acids diffuse into the resins gel and become tightly bound. To reduce fouling, the following methods are suggested: (1) water treatment (flocculation and slow sand filtration often permit removal of the organic fouling), (2) proper resin selection (use of the porous resin such as the Amberlite IRA-401 or IRA-402 which have a much higher capacity for the fouling bodies than do the conventional resins), and (3) resin cleanup (frequent warm-brine treatment, 5% sodium chloride, removes significant amounts). Warm caustic regeneration has been cited also as ad-

vantageous. When fouling has been permitted to build up, oxidation treatment is suggested with 0.5 to 2 percent sodium hypochlorite in 1 to 2 percent caustic. This causes excessive attack on Type II resins but may be used on Type I resins. (Bean-AWWA)
W72-03477

SIMULATION OF FILTRATION ON ELECTRONIC DIGITAL COMPUTER.
University Coll., London (England).
K. J. Ives.
Journal of the American Water Resources Association, Vol 52, No 7, p 933-939, July 1960. 1 fig, 2 tab, 1 ref.

Descriptors: *Water treatment, *Filtration, *Computer, *Design, Simulation analysis.

A relatively simple numerical procedure and program is described believed satisfactory for simulating filtration on an electronic digital computer. The program permits extrapolation of experimental filter runs to be made and design tables to be prepared for filter planning and operation. As more complex filtration situations come under study, this method will provide a basis for the more complex programs required. Results are given from a computer run, the operating data for which were derived from a filtration experiment. (Bean-AWWA)
W72-03481

THEORY OF FLOW IN FILTER MEDIA.
City of Detroit, Mich. Dept. of Water.
D. Feben.
Journal of the American Water Works Association, Vol 52, No 7, p 940-958, July 1960. 3 fig, 3 tab, 17 ref.

Descriptors: *Water treatment, *Filtration, *Flow rates, Head loss, Filters, Porous media, Water purification.
Identifiers: *Granular media.

The theory is discussed of all phases affecting the flow in granular media along with the formulas presented by various researchers for flow and expansion of filter beds. Filter media, size distribution analysis, grain arrangement and porosity, flow problems, initial head loss, rate of head loss, backwash, and gravel are discussed. (Bean-AWWA)
W72-03482

USE OF SODIUM HEXAMETAPHOSPHATE IN MANGANESE STABILIZATION.
Hagan Chemicals and Controls, Inc., Pittsburgh, Pa.
G. L. Illig, Jr.
Journal of the American Water Works Association, Vol 52, No 7, p 867-874, July 1960. 1 fig, 3 tab.

Descriptors: *Water treatment, *Stabilization, *Manganese, *Phosphates.
Identifiers: *Sodium hexametaphosphate, Iron.

At least 40 municipal and industrial water plants have used sodium hexametaphosphate to stabilize dissolved manganese which passed through the treatment plant. The phosphate must be well mixed with the water before the manganese (and iron) are oxidized and start to precipitate. It must be applied in definite proportions, usually a ratio of 2 ppm glassy phosphate for each one ppm of manganese and iron, though under some conditions a 4:1 ratio is required. In general if the manganese and iron are less than 1 ppm, phosphate dosage should be 2 ppm which allows for adsorption of a portion of the phosphate on the metal pipe surfaces. Development of color is prevented. Iron has been found to form an almost colorless iron phosphate complex, though present as a well dispersed colloidal suspension. Sodium hexametaphosphate has been used successfully under

different operating conditions and in waters of markedly different chemical characteristics. (Bean-AWWA)
W72-03488

RECOVERY AND REUSE OF ALUM SLUDGE AT TAMPA.
Tampa Dept. of Water, Fla.
J. M. Roberts, and C. P. Roddy.
Journal of the American Water Works Association, Vol 52, No 7, p 857-866, July 1960. 4 fig, 7 tab, 3 ref.

Descriptors: *Water treatment, *Sludge, *Sulfuric acid, Lime, Water softening, Sludge, Florida.
Identifiers: *Aluminum sulfate, Tampa (Florida), Alum.

Laboratory and plant scale tests proved that the process is practical for the Tampa plant. Two conventional settling basins with sludge collectors will be added. This operation of recovering sludge, and conversion with sulfuric acid to aluminum sulfate saved about 70 percent of the cost of alum for coagulation. In certain periods when the water has high alkalinity and a small color content, lime is used for softening. At such periods aluminum hydroxide sludge is not available for recovery. (Bean-AWWA)
W72-03491

SIGNIFICANCE OF RADIOACTIVITY IN WATER SUPPLY AND TREATMENT.
Texas State Dept. of Health, Austin.
H. A. Bevis.
Journal of the American Water Works Association, Vol 52, No 7, p 841-846, July 1960. 2 tab, 4 ref.

Descriptors: *Water treatment, *Radioisotopes, *Radioactivity, Coagulation, Sedimentation, Filtration, Ion exchange.

With increased availability of radioisotopes, there is increased opportunity for pollution of water. In the years 1946-1955, shipment of activity from Oak Ridge totaled 198,464 curies. However, by the end of 1958 the total was 608,672 curies. Present regulations allow disposal of certain small amounts to the public sewer system, thereby entering water courses. Reactors, fuel processing plants and nuclear weapons testing are other sources of pollution. Removals of about 45 percent may be expected with coagulation and sedimentation, rising to 70 percent with filtration, and 90 percent with lime-soda softening. Ion exchange is very efficient and may remove 99.99 percent. (Bean-AWWA)
W72-03499

5G. Water Quality Control

PRECIPITATION OF HEAVY METALS FROM NATURAL AND SYNTHETIC ACIDIC AQUEOUS SOLUTIONS DURING NEUTRALIZATION WITH LIMESTONE.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
R. O. van Everdingen, and J. A. Banner.
Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bulletin No 35, 1971. 21 p, 7 fig, 2 tab, 4 ref.

Descriptors: *Chemical precipitation, *Heavy metals, *Acidic water, *Neutralization, *Limestones, Water chemistry, Test procedures, Analytical techniques, Hydrogen ion, Concentration, Chemical reactions, Alkalies (Bases), Water treatment, Industrial wastes, Mine acids, Water pollution control.
Identifiers: Acid neutralization, Crushed limestone.

Iron, aluminum, manganese, copper, lead, and zinc in natural and synthetic acidic water with

hydrogen ion concentrations ranging from .004 to .00063 were circulated through crushed limestone. This resulted in neutralization of the acidity and removal of up to 99.9% of the dissolved Fe, 96.6% of Al, 35 to 52% of Mn, 99.8% of Cu, 99.9% of Pb and 97.1% of Zn. A comparison of the results obtained for synthetic acidic water and natural acidic water shows that, for some of the ions, a minimum concentration is approached which seems to be independent of the original concentration in the solution. The respective minimum values in ppm, for the natural and synthetic water, are: Fe 0.05 and 0.6; Al less than 0.3; Mn 0.22 and 4.5; Cu 0.008 and 0.006; Pb less than 0.01 and 0.002; Zn 3.7 and 5.0. The process holds some promise for the treatment of acidic heavy-metal bearing drainage from sulfide-ore mines, dumps and tailing ponds. The sludge resulting from the neutralization process has better settling characteristics (smaller sludge volume) if limestone is used than if lime is used. (Woodard-USGS)
W72-02956

CHANGES IN WATER QUALITY PARAMETERS OF RESERVOIRS DURING REGULATED FLOW CONDITIONS.
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
J. Clement Burdick, III and Floyd C. Larson.
Available from NTIS as PB-205 421, \$3.00 in paper copy, \$0.95 in microfiche. Tennessee Water Resources Center, Knoxville, Research Report No. 23, December 1971, 146 p, 32 fig, 8 tab, 42 ref. OWRR Project A-013-TENN (2).

Descriptors: *Water quality control, Tennessee, *Reservoirs, *Treatment facilities, *Flow control, *Sewage treatment, Activated sludge.
Identifiers: *Treatment plant modification, *Fort Loudoun Reservoir (Tenn) Water quality changes.

As a result of several investigations dating from 1966 to the present, a rather comprehensive surveillance of water quality conditions has been maintained in Fort Loudoun Reservoir on the Tennessee River near Knoxville, Tennessee. This report examines the significance of the observed reservoir water quality and considers the role of controlled discharges through the reservoir in effecting these conditions. In addition the results of these investigations supported by this project are summarized. During the period covered by these investigations, the Knoxville Third Creek Sewage Treatment Plant was upgraded from a primary plant to a secondary (activated sludge) treatment plant. Comparison of the collected data is undertaken herein to elucidate the impact of these modifications upon reservoir water quality. Consideration is given to the improvements of water quality as related to the expenditure for modification of the treatment facilities.
W72-02972

MICROAEROPHILIC BIODEGRADATION OF TALLOW-BASED ANIONIC DETERGENTS IN RIVER WATER.
Agricultural Research Service, Philadelphia, Pa.
Eastern Utilities Research and Development Div.
E. W. Maurer, T. C. Cordon, and A. J. Storton.
J Amer Oil Chem Soc. 48 (4): 163-165. Illus. 1971.
Identifiers: Aerophilic, Anionic, Bio, Degradation, Detergents, Micro, River, Sulfated, Tallow.

A total 9 anionic detergents from 5 general classes (alcohol sulfates, ether alcohol sulfates, sulfated alkanolamides, alpha-sulfo esters and alkylbenzenesulfonates) were rapidly screened for biodegradability under aerobic and microaerophilic conditions in river water at 25 and 35 C. In decreasing order, the ease of biodegradation under microaerophilic conditions at 35 C was as follows: alcohol sulfates, sulfated alkanolamides, alpha-sulfo fatty acid esters and ether alcohol sulfates. Linear alkylbenzenesulfonate did not degrade.—Copyright 1971, Biological Abstracts, Inc.
W72-02979

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

ALUMINUM OXIDE AS ABSORBENT FOR NATURAL WATER-SOLUBLE YELLOW MATERIAL. Hydrobiologisch Instituut, Nieuwersluis (Netherlands). J. R. Moed. *Limnol Oceanogr.* 16 (1): 140-142. Illus. 1971. Identifiers: Absorbent, Aluminum, Natural, Oxide, Soluble, Yellow.

For 2 types of fresh-water investigated, under the conditions given, adsorption of soluble organic yellow material to aluminum oxide was about 98% on the basis of OD (optical density) at 270 m micron. Elution of yellow material could be realized up to recoveries of 66-80% using phosphate buffers at pH = 7. At phosphate concentrations of 0.008 M and 0.3 M and pH = 7 several fractions of yellow material could be eluted.—Copyright 1971, Biological Abstracts, Inc. W72-03050

EFFECTS OF OXYGEN DEMAND ON SURFACE REAERATION. Illinois Univ., Urbana. Dept. of Civil Engineering. E. R. Holley, T. Micka, H. Pazwash, and F. W. Sollo. Available from the National Technical Information Service as PB-205 751, \$3.00 in paper copy, \$0.95 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 46, ILLU-WRC-71-0046, Sept. 1970. 80 p, 21 fig, 2 tab, 79 ref. OWRRA A-037-ILL (1).

Descriptors: *Reaeration, *Dissolved oxygen, *Oxygen demand, Diffusion, Turbulence, Water pollution control, Boundary layers, Turbulent boundary layers, Biochemical oxygen demand. Identifiers: Oxygen boundary layer.

The transport of diffusion of dissolved oxygen in the thin region or film immediately below the water surface is the most critical region in determining the oxygen adsorption rate. The surface film is actually an oxygen boundary layer. It should be expected that the film or boundary layer thickness changes with Schmidt number as well as mixing conditions and that the transport through the film can be represented by a diffusion model, as in other boundary layer problems. Temperature measurements and the heat transfer analogy indicate that the diffusion coefficient in the film can be approximately equal to the molecular diffusivity even when turbulence is present. Analytical solutions are presented for the vertical concentration distribution both in the turbulent film and below the film for various situations involving no oxygen demand, sulfite, or BOD. The analytical solutions are interpreted in terms of the mechanics of reaeration for the various situations. Experiments were performed at 2 deg. C and at 20 deg. C to evaluate the effects of BOD on reaeration rates. For both temperatures, the reaeration rates were about 1.5 times the rate for pure water. Since biological activity is almost non-existent at 2 deg. C, the increase must have been due to the physical presence of the organisms. W72-03058

HANDLING METHODS FOR LIQUID MANURE ARE TESTED. D. W. Bates. *Hoard's Dairyman*, Vol. 116, p 273, March 10, 1971, 3 fig.

Descriptors: *Waste disposal, Waste dumps, *Farm wastes, *Cattle, Storage tank, *Waste storage, Liquid wastes. Identifiers: Barn heat.

Methods for handling liquid manure stored in a large external tank over an extended period of time were evaluated. The 150,000 gallon storage tank was constructed at a right angle to the end of a 60-cow tie stall barn. A cover of woven wire, polyethylene and baled straw was used in winter; the tank was uncovered in the summer. No conveyor system was installed. Waste heat from the

barn's ventilation system was exhausted into the tank to prevent or reduce freezing. Pumps were used to level and remove the tank's contents. Conclusions are: (1) Manure stored in a large tank can be agitated and removed without difficulty under proper management; (2) Manure deposited in one end of a long tank will distribute itself sufficiently under its own weight so a conveyor is not necessary; (3) Waste heat from a barn's ventilation system is valuable in preventing freezing in an exposed manure storage tank. (Hazen-Iowa State) W72-03150

RESUME OF STUDIES AND CONTROL OF EURASIAN WATERMILFOIL (MYRIOPHYLLUM SPICATUM L.) IN THE TENNESSEE VALLEY FROM 1960 THROUGH 1969. Tennessee Valley Authority, Muscle Shoals, Ala. Environmental Biology Branch. For primary bibliographic entry see Field 03B. W72-03230

SCREW PRESS DESIGN PARAMETERS FOR DEWATERING WATER HYACINTH (EICHORNIA CRASSIPES). Florida Univ., Gainesville. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 03B. W72-03232

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION. Robert S. Kerr Water Research Center, Ada, Okla. L. E. Leach, W. R. Duffer, and C. C. Harlin, Jr. Available from the National Technical Information Service as PB-205 825, \$3.00 in paper copy, \$0.95 in microfiche. Robert S. Kerr Water Research Center Report, Federal Water Pollution Control Administration, 1968. 24 p, 7 fig, 1 tab, 13 ref. FWPCA Project 16080--00/68 PB-205 825.

Descriptors: *Reservoirs, *Thermal stratification, *Aeration, *Heat transfer, *Water quality control, Oxygenation, Oklahoma, Ecology, Cooling, Diffusion, Water circulation, Mass transfer, Thermodynamic behavior, Methodology, Water pollution control. Identifiers: *Reservoir destratification.

The development of a system for thermal destratification of large reservoirs is presented. Rate of change of the water volume affected and the magnitude of aeration were determined in the central pool of Eufaula Reservoir in eastern Oklahoma. The pilot system was undersized for circulating the entire volume of the central pool, yet 65,000 acre-feet of water below a depth of 22 feet was aerated by the 25th day of operation. Aeration effects extended as far as 2.5 miles from the point where the system was installed, covering an area of approximately 3,000 acres at a depth of 22 feet. Rate of change of hydrodynamic aeration trajectories and thermal effect versus mechanical energy input are discussed. Pilot system design and operational limitations served as a guide for design of a more effective system for continued research and development of destratification of large reservoirs. Interesting changes in vertical distribution and concentrations of fish have prompted proposals from other agencies to conduct parallel research on effects of destratification on fish populations and other biological parameters. (Woodard-USGS) W72-03234

THE COMPONENTS OF OXYGENATION IN FLOWING STREAMS. Robert S. Kerr Water Research Center, Ada, Okla. F. S. Stay, Jr., W. R. Duffer, B. L. DePrater, and J. W. Keeley. Available from the National Technical Information Service as PB-205 826, \$3.00 in paper copy, \$0.95 in microfiche. Robert S. Kerr Water

Research Center Report, Federal Water Pollution Control Administration, April 1967. 19 p, 7 fig, 2 tab, 16 ref. EWPCA Project 16050--04/67 PB-205 826.

Descriptors: *Water pollution sources, *Waste assimilative capacity, *Streams, *Running waters, *Oxygenation, Model studies, Methodology, Waste water (Pollution), Photosynthesis, Diffusion, Respiration, Benthos.

A method is presented which can be used to separate and measure the components of reaeration in flowing waters. Plastic chambers are used to separate the effects of photosynthesis diffusion, and respiration on the oxygen balance of a stream's regimen and further separate these parameters according to the benthos and organisms which are free-floating. Conditions in a black chamber represent an oxygen demand due to respiration only, because it is closed to the atmosphere eliminating diffusion, and it does not allow sunlight for photosynthesis. The oxygen concentration in a clear chamber is affected by respiration and photosynthesis but not diffusion because it is also closed to the atmosphere. The difference in oxygen production between the clear and black chambers is the amount of oxygen produced by photosynthesis. Conditions in a clear chamber, which is open to the atmosphere, represent photosynthesis, diffusion, and respiration. Dissolved oxygen measurements were made in conjunction with supporting information such as atmospheric pressure, temperature, stream velocity profile, light intensity, and the percent of light transmittance to the benthos. (Woodard-USGS) W72-03235

WASHING AWAY OF PHOSPHORUS AND POTASSIUM FROM AREAS DRAINED FOR FORESTRY AND TOPDRESSED AT DIFFERENT TIMES OF THE YEAR (ERI AJANKOHTINA ANNETTUJEN FOSFORIA KALILANNOITTEIDEN HUHTOUTUMISESTA METSAOJITUSALUEILTA). K. Karsisto, and H. Ravela. *Suo (Helsinki)*, Vol 22, No 3-4, p 39-46, September 9, 1971. 10 fig, 14 ref.

Descriptors: *Water quality control, *Water quality, *Water treatment, *Runoff, *Fertilization, Application methods, Rates of application, Fertilizers, Potash, Potassium, Phosphorus, Phosphates, Nutrients, Ditches, Drainage, Sampling, Water analysis, Snow cover, Seasonal. Identifiers: *Finland, *Ditch water.

The influence of potash and phosphorus application on the potassium and phosphorus contents of ditch water and on the washing of phosphorus and potassium at various rates of daily runoff and different fertilization treatments was examined on the basis of an analysis of about 400 water samples collected from two experimental fields near Pyhäkoski in the Oulu Province of Finland. PK fertilization increased the potassium and phosphorus contents of the ditch water. The potassium content was also higher in narrow ditch spacings than in broader spacings. The rate of fertilizer application and the place of application in the strip between ditches were of lesser importance than the time of application, particularly in the case of the potassium content of the ditch water. Fertilizer application to the intact snow cover in the winter and to wet snow in the spring resulted in higher potassium contents than application to bare ground. The nutrient content of the ditch water reached a maximum when the runoff rate for phosphorus was 4 mm/day and the runoff rate for potassium was 7 mm/day. Total washing of nutrients per hectare at different ditch spacings can be determined when the magnitude of the daily runoff is known. (Josefson-USGS) W72-03237

INFILTRATION OF WASTE WATER INTO PEAT SOIL (JATEVESIEN SUOHONIMEITYKSESTA), S. Surakka, and A. Kampil. Suo (Helsinki), Vol 22, No 3-4, p 51-58, September 9, 1971. 2 fig, 5 ref.

Descriptors: *Waste water treatment, *Waste water disposal, *Waste water (Pollution), *Peat, *Infiltration, Drainage, Drains, Ditches, Soil water, Vegetation, Biomass, Nutrients, Nitrogen, Phosphorus, Potassium, Sampling, Water pollution control. Identifiers: *Finland, Infiltration ditches.

Investigations were conducted in the summer of 1970 in the vicinity of Kesalahti village in the North Karelian Province of Finland to study the waste water infiltration ditch system in use at the village and to examine the vegetation and soil water of the peatland area. The main ditch of the ditch system, which has been in operation since 1957, is 118 m long, 4-5 m wide, and .3 m deep, and receives the waste water from about 400 inhabitants. The ditches serving the forest drains are located some 20 m from the infiltration ditches. In the summer of 1970 the vegetation along the infiltration ditches assimilated a total of 175 kg of nitrogen, 37 kg of phosphorus, and 200 kg of potassium. Due to vegetation the total phosphorus content at some sampling points was 0.38% in 3 years and as much as 0.70% in 13 years. Nitrogen content reached 2% at the sampling points closest to the infiltration ditch. In some areas the increase in nitrogen content was observed to a depth of 2 m. Infiltration as a purification method may be recommended for small communities provided at least 0.4-0.8 m of infiltration ditch per inhabitant is in use at all times. The waste waters of a community with 300-600 inhabitants can be effectively infiltrated into an area of 1 ha for about 3 years when ditch spacing is 20 m (infiltration ditch spacing 40 m). In the case of Kesalahti, the waste waters of 400 inhabitants were infiltrated into an area of 1.5 ha for a period of 14 years, resulting in a less effective purification process. (Josefson-USGS) W72-03238

WATER TEMPERATURE AS A QUALITY FACTOR IN THE USE OF STREAMS AND RESERVOIRS, Colorado State Univ., Fort Collins. Engineering Research Center. John C. Ward. Available from NTIS as PB-205 821, \$3.00 in paper copy, \$0.95 in microfiche. Partial completion report submitted to office of Water Resources Research on December 6, 1971. 1 fig, 2 tab, 19 ref. OWRR A-006-COLO, 14-01-0001-1625.

Descriptors: *Thermal pollution, *Cooling towers, *Water temperature, *Reservoir evaporation, *Electric power industry, *Biochemical oxygen demand, Thermal radiation, Salinity, Heat balance, Thermal stratification, Solar radiation, Air temperature. Identifiers: *Water quality hydrology, *Irrigation return flows, *Thermal pollution economics, *Water cooling tower costs, Spray pond evaporation, Spray pond cooling, Western U.S.

This report is a summary of 11 papers published in 15 different journals covering the following topics in water quality hydrology with special reference to water temperature: surface water freezing, quality of irrigation return flows, surface water temperatures, effects of temperature on rate of BOD exertion and ultimate BOD exerted, effect of impoundment on water quality, economics of thermal pollution control, minimum cost design and operation of water cooling towers, surface water heat balance, and spray pond evaporation and water cooling. Results of this work show that the beginning and ending dates of surface water freezing in lakes and streams can be accurately predicted from previous records. Also, the overturning of lakes depends on the minimum surface water temperature experienced on an annual basis

(some shallow lakes are not temperature stratified). Both the rate of exertion and the ultimate BOD exerted increase with temperature up to about 38°C. While evaporation reduction needed in the Western U.S. to improve water quality, the resulting temperature increase may be a serious problem. The cost of preventing thermal pollution would probably increase the price of electricity about 1%. W72-03296

FIXATION OF RADIOACTIVE WASTES IN SOIL AND SALT CAKES WITH ORGANIC POLYMERS, Batelle Memorial Inst., Richland Wash. Pacific Northwest Lab. B. W. Mercer, A. J. Shuckrow, and L. L. Ames. Available from the National Technical Information Service as BNWL-1220. \$3.00 per copy, \$0.95 microfiche. Report BNWL-1220, April 1971. 41 p.

Descriptors: *Radioactive waste disposal, *Nuclear wastes, *Waste water (Pollution), Soil disposal fields, *Leaching, *Water quality, Salts, Sodium compounds, Water pollution sources, Soil contamination, Soil properties, Soil structure, Plastics, Resins, Water pollution control, Soil mechanics, Ion exchange. Identifiers: Fixation, Radionuclide movement through soil, Leach rate, Combustion.

Organic polymers of the type used in fiberglass laminates were evaluated for use in the fixation of radioactivity in soil and preformed salt cakes. In situ fixation of the radioactivity is to be accomplished by injection of the polymers into soil or preformed salt cakes. This approach circumvents the costs and hazards associated with the alternate method of excavating the highly radioactive soil or salt for processing or burial. The results of laboratory studies show that water leach rates of radioisotopes or ions from the soil and salt cakes were reduced by 99.9% or more by incorporation of the soil or salt in a suitable resin matrix. Injection of catalyzed liquid resin into soil with subsequent polymerization to form a hard mixture was successfully demonstrated in both laboratory and field experiments. Flammability studies have demonstrated that the soil-resin combinations will not support combustion while mixtures of resin and sodium nitrate or resin with a simulated waste salt marginally support combustion. (Houser-ORNL) W72-03312

POWER GENERATION AND ENVIRONMENTAL CHANGE, American Association for the Advancement of Science, Washington, D.C. Committee on Environmental Alteration.

MIT Press, Cambridge, Mass., 1971. 440 p.

Descriptors: *Radioactivity, *Nuclear wastes, *Nuclear powerplants, *Environmental effects, Pumped storage, Electric power production, Coals, Oil, Sulfur, Air pollution, Water pollution sources, Radioisotopes, Absorption, Public health, Genetics, Radioactivity effects. Identifiers: Atmospheric chemistry.

The volume is a more complete exposition of the subject matter of the Symposium of the Committee on Environmental Alteration, American Association for the Advancement of Science, Dec. 28, 1969. Additional contributions are: an introduction; a further discussion of the health and safety aspects of nuclear radiation; a more complete statement of long-term genetic effects; an independent look at radiation-dose limits; a clarification of radioactivity from fossil-fuel plants; and environmental aspects of large pumped-storage hydroelectric plants, sulfur in oil, and atmospheric chemistry. (See also W72-03331 and W72-03332) (Bopp-ORNL) W72-03330

PUMPED STORAGE HYDROELECTRIC PROJECTS, Mitre Corp., Bedford, Mass. David A. Berkowitz. In: Power Generation and Environmental Change, MIT Press, Cambridge, Mass., 1971, p 158-172. 2 fig, 13 ref.

Descriptors: *Environmental effects, *Pumped storage, *Resource allocation, Impaired water quality, Power system operations, Reservoir leakage, Underseepage, Reservoir sites, Social impact, Recreation facilities, Bank stability, Water resources development, Fish migration.

In the United States (1970), the pumped storage generating capacity in operation or under construction was 7.1 (in million kilowatts), and approval for ten was pending before the Federal Power Commission. For comparison, in January 1968 the installed generating capacity of conventional hydroelectric power was 46 (represented about 18% of the nation's total generation capacity) and additional facilities planned and under construction by the federal government or licensed to nonfederal owners would about double the present capacity. Total hydroelectric potential of the United States has been estimated as 175, exclusive of pumped storage. Many more sites are suitable for pumped storage than for conventional dams, since the area of the reservoir is about 1000 times less; however, percolation from the upper reservoir raises questions involving land stability and water quality which must be evaluated in initial site selection studies. The approach of multipurpose land use may be an effective method for reconciling conflicting societal demands on our environmental resources. Reversal of river flow pumping operations will affect the migratory movement of fish. (See also W72-03330) (Bopp-ORNL) W72-03331

RADIATION DOSE LIMITS, Maryland Academy of Sciences, Baltimore. Study Panel on Nuclear Power Plants.

In: Power Generation and Environmental Change, MIT Press, Cambridge, Mass., 1971, p 94-106. 1 fig, 2 tab, 11 ref.

Descriptors: *Nuclear wastes, *Public health, *Radioactivity effects, *Regulation, Water pollution control, Maryland, Chesapeake Bay, Nuclear powerplants, State jurisdiction, Water resources development, Environmental effects, Risks, On-site investigations, Research facilities, Genetics, X-rays.

A Maryland Academy of Sciences study panel (May 1969-Jan. 1970) on the Calvert Cliffs plant recommended: (1) ecological and oceanographical studies by potential users, (2) microbiological and radiation monitoring of all substantial discharges into Maryland environments by the state, (3) that Maryland continue its policy against permitting reprocessing or disposal of spent nuclear fuels within the state, and (4) that the Atomic Energy Commission be asked to make a more stringent allocation to the nuclear power industry of radiation dose limits. It was considered that the Calvert Cliffs plant was an acceptable risk when looked upon as an experimental tool. The dose from natural background radiation is about 3-6 rem/30 yrs. (The mean age for childbearing is 30 years.) As a marker of the 'involuntary' exposure to which the general population may be exposed, it is likely that the American medical profession will reduce the diagnostic x-ray genetic dose to 0.2 rem/30 yrs. A United Kingdom committee expected that the maximum permissible genetic dose allocated to all types of radioactive waste disposal could be kept as low as 0.1 rem/30 yrs (about 1/10 the present limit). (See also W72-03330) (Bopp-ORNL) W72-03332

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

DISPOSAL OF RADIOACTIVE WASTES INTO RIVERS, LAKES AND ESTUARIES,
International Atomic Energy Agency, Vienna (Austria).

Available from UNIPUB, Inc.; P. O. Box 433; New York, N.Y. 10016; \$3.00.

Descriptors: *Water pollution control, *Radioactivity effects, *Nuclear wastes, *Path of pollutants, *Radioisotopes, Absorption, Aquatic life, Reviews, Monitoring, Radioactivity techniques, Regulation, International Commissions, Surface waters, Aquatic life, Ecosystems, Systems analysis, Forecasting, Public health, On-site investigations, Liquid wastes, Radioactive wastes, Rivers, Lakes, Estuaries, Columbia River, Pacific Ocean. Identifiers: International Commission on Radiological Protection, World Health Organization.

Disposal into surface waters is considered in the present publication which is derived from updating of Safety Series No. 10 (IAEA, 1963) by a panel from 7 countries which convened in January 1969. Contamination of sub-surface waters was covered in Safety Series No. 15, 'Disposal of Radioactive Waste into the Ground' (IAEA, 1965). With acceptable cost penalties, radioactive discharges can be limited such that the effort for environmental surveillance can be lessened, and the nuclear industry need not be limited by the fear of exceeding dose limits. A discussion of management policy includes the benefit-to-cost concept, national organization, and international collaboration. Examples of the critical-nuclide, critical-pathway, critical-population-group concept of assessing radiation risk are given in appendices. (Bopp-ORN) W72-03343

GASOLINE IN GROUNDWATER IN LOS ANGELES COUNTY,
California Inst. of Tech., Pasadena.
J. E. McKee, F. B. Laverty, and R. M. Hertel. Preprint, presented at Water Pollution Control Federation Conference, 44th, Session 3, No. 1, October 4, 1971. 20 p, 5 fig, 7 ref.

Descriptors: *Gasoline, *Groundwater, *Drawdown, *Soil contamination, Gas chromatography, Spectroscopy, Wells, Allurium, Porosity, Pseudomonas, Bacteria, Specific yield, Specific retention, California.
Identifiers: *Arthrobacter bacteria, *Western Oil and Gas Association, *Pellicular, *Los Angeles, Glendale.

In 1968, in the Los Angeles-Glendale area, a major gasoline discovery which was made in a groundwater basin instigated measures to ameliorate the pollution and research efforts needed to understand this unique problem. The large volume of gasoline was discovered between two large cones of heavy drawdown, Glendale's Grandview well field and the City of Los Angeles' Crystal Springs wells, and Los Angeles' Pollock wells, on the relatively flat groundwater table. By August 1969, the Western Oil and Gas Association (WOGA) had drilled about 30 wells to monitor the areal extent and depth of free gasoline. Selected wells were equipped with skimmer pumps. Through October 1969 about 20,000 gallons of gas had been recovered. The WOGA consultants and advisors also decided to install several 'sink' areas to create drawdown cones and thus reverse any gradient toward the Pollock wells. Experiments were conducted to determine the porosity, permeability specific yield, and specific retention of dry soil exposed to water and gasoline. From column studies it became apparent that free gasoline would not move far through the soil formation without much of it becoming pellicular. Once it has become pellicular it was shown that the gas would not be rendered free again by a rising water table. Tests also showed that several species of bacteria of the Pseudomonas and Arthrobacter genera utilize gasoline as a source of energy in the presence of trace nutrient salts and adequate dissolved oxygen.

This finding may prove to be the best parameter for final cleanup operations, since the assay of these bacteria is simple and fairly rapid. (Biggs-Texas) W72-03353

STRUCTURAL STRENGTHS OF PIPE MATERIALS,
Utah State Univ., Logan. Engineering Experiment Station.
For primary bibliographic entry see Field 08G. W72-03355

TASK FORCE APPROACH TO SOLVING A MERCURY PROBLEM IN THE CHLOR-ALKALI INDUSTRY,
Olin Corp., Stamford, Conn. Chemicals Div.
For primary bibliographic entry see Field 05D. W72-03356

DETROIT AIMS FOR SAVINGS WITH PURE OXYGEN AERATION,
Detroit Metro Water Dept., Mich.
G. Remus, D. Suhr, and G. Hubbell. Preprint, presented at Water Pollution Control Federation Conference, 44th, Session No. 21, October 7, 1971. 17 p, 11 fig.

Descriptors: *Michigan, *Aeration, *Activated sludge, *Dissolved oxygen, Tricking filter, Coliform bacteria, Sewage effluent, Michigan. Identifiers: *Detroit, Air-lift pumps.

In 1966, Detroit made specific commitments with the State of Michigan to provide sewage disposal service for the entire metropolitan area and to drastically reduce the waste load going into the Detroit River and hence Lake Erie. As a first step, a 200 gpm test facility was constructed. The air-lift pump principle was applied to a coarse bubble diffuser tank design and this principle alone allowed a 50% saving in land area for aeration tank site. Results from the test facility indicated that the sewage was amenable to treatment with the step-feed activated sludge process. Tests also indicated that by increasing upflow velocities and lengthening the flow pattern when utilizing the air-aerated activated sludge, the clarifier overflow rate design could be economically doubled from 800 gpd/sq. ft. to 1600 gpd/sq. ft. Another system, tested by the Linde Division of Union Carbide, used high purity oxygen to efficiently support the activated sludge process and at greater economy than conventional air-aerated activated sludge. Benefits of this process are: (1) effluent is produced with a high dissolved oxygen content; (2) less odors; (3) less residue; (4) more potential for almost total automatic operation. Detroit proceeded with construction, and because neither the deep tank, high rate, air aeration concept nor the oxygenated activated sludge process has ever been implemented on a scale of that magnitude, an actual economic evaluation is to be made on each. Early estimates are that on a plant wide basis, overall operating and capital costs will have been trimmed by \$21.35/mil gal. (Biggs-Texas) W72-03357

SEMINAR ON WATER POLLUTION BY OIL,
Ministry of Housing and Local Government, London (England). Directorate of Engineering.
L. E. Ellis. Water Pollution Control, Vol 70, 1971, p 578-583, 30 ref.

Descriptors: *Water pollution control, *Oily water, Inland waterways, Water purification, Sewer systems, Scotland, *Oil wastes, Water pollution sources.
Identifiers: *Oil spillage, *Oil refinery, Oil interceptors, Bund walls, Diving sea birds, Aviemore.

Papers presented at the Seminar of Water Pollution by Oil in Aviemore, Scotland in May 1970 focused on causes of pollution, who was responsible

for pollution, methods of preventing pollution, and future pollution laws and standards that need to be passed. It was pointed out that accidental discharges of oil products are no longer exceptional. Between April 1966 and March 1967 river authorities in England and Wales recorded 296 cases of oil pollution. However, only 22 of 483 cases of oil pollution in 1968-1969 were connected with the oil industry. The major sources of oil pollution come from the industrial consumer who was responsible for 430 cases out of the total of 483. It was found that precautions like the provision of bund walls around storage tanks and interceptors on drainage systems coupled with better maintenance of installations and more effective supervision of men handling oil would have prevented 411 out of 426 accidents. One suggestion for a solution to the problem was a concurrent tightening and extension of existing legislation to provide a more effective means of enforcement. The question of design and maintenance of oil interceptors was raised, and there was general agreement that for the layer installations the single-chamber type was more efficient and more easily fitted with mechanical skimming devices than were multi-compartment interceptors. A separate session was devoted to a discussion about the disposal of waste oil. (Biggs-Texas) W72-03358

A CORROSION INHIBITOR PROCESS FOR DOMESTIC WATER,
Long Beach Dept. of Water, Calif.
W. B. Murray. Journal of the American Water Works Association, Vol 62, No. 10, October 1970, p 659-662, 4 fig, 1 tab, 4 ref.

Descriptors: *Water treatment, *Water pollution control, *Corrosion control, Corrosion, Chemical precipitation, Hydrogen ion concentration, Laboratory tests, On-site tests.

Corrosion of metallic plumbing in domestic (potable) water supplies is difficult to control because only non-toxic substances at low dosage levels can be used. A mixture of materials which has proven successful as a corrosion inhibitor consists of three mole parts of zinc sulphate, 2 mole parts of sulfamic acid and 2 mole parts of monosodium orthophosphate. When added to near neutral water (pH 6.5 - 8.3) in small quantities (3 ppm) the zinc and phosphate ions immediately precipitate as zinc phosphate. The precipitate is so finely divided that it resists settling and is taken out of solution only upon collision with the solid walls of the plumbing. It adheres to these surfaces in a thin layer and apparently does not continue to build up into a thick crust. This addition has been approved for use in public water supplies by the Health Department of the State of California. In June of 1967, the City of Long Beach, California began using this inhibitor in an attempt to stop a serious problem of pitting type corrosion in one section of the water system and a plugging type corrosion in the remainder of the system. Dosages sufficient to provide 3 ppm of zinc as zinc sulfamate was applied for a 2 week period. The dosage was then reduced to provide zinc at 1 ppm indefinitely. Pitting has been stopped and tests indicate a 95% reduction in corrosion. (Goessling-Texas) W72-03367

RETENTION OF DISSOLVED ORGANIC ACIDS IN SEAWATER BY VARIOUS FILTERS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
James G. Quinn, and Philip A. Meyers. Limnol Oceanog. 16 (1): 129-131, 1971. Identifiers: Acids, Dissolved, Fatty-Acids, Filters, Organic, Retention, Sea, Water.

Dissolved fatty acids and natural lipid material containing these acids are removed from seawater by certain filters commonly used to separate dissolved from particulate organic matter. Whatman 54 filter paper was the least retentive of the filters

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tested and is recommended for the isolation of dissolved lipids in seawater.—Copyright 1971, Biological Abstracts, Inc.
W72-03494

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

COMPUTER APPLICATIONS IN HYDROLOGY. Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 07C.
W72-02958

METHODOLOGIES FOR WATER RESOURCES PLANNING: DDP AND MLOM (TLOM). Illinois Univ., Urbana. Dept. of Civil Engineering. V. T. Chow.
Available from the National Technical Information Service as PB-205 750, \$3.00 in paper copy, \$0.95 in microfiche. Illinois Water Resources Center, Urbana, Publication No. 47, UILU-WRC-71-0047, Nov. 1971. 50 p, 5 fig, 3 tab, 20 ref. OWRR B-030-ILL.

Descriptors: *Dynamic programming, Optimization, *Systems analysis, *Planning, Model studies, Irrigation efficiency, Reservoir operation, Operations research.
Identifiers: *Hydroeconomic analysis.

This is the completion report for the first phase of a research program on advanced methodologies for water resources planning. A number of advanced concepts of water resources planning are investigated in order to develop practical methodologies for optimization of water resources systems. Two new methodologies are developed; the discrete differential dynamic programming (DDDP), and the multi-level optimization model (MLOP). The DDDP is a computer program which can overcome the multi-dimensional difficulty often involved in the optimization of a complex water resources system; and it can greatly save the cost of analysis by reducing the required computer storage capacity to several hundredths of the required computer time to tenths of those required by the conventional dynamic programming technique. The MLOM is a novel scheme to resolve a complicated water resources system into a form that can be optimized at several levels for a general solution. These methodologies are being introduced to actual water resources planning processes. Principles and procedures of DDDP and MLOP are described including an optimal operation of a reservoir network for hydropower and irrigation, and a two-level optimization of farm irrigation systems (TLOM).
W72-03056

MAXIMUM WAVE HEIGHT PROBABILITIES FOR A RANDOM NUMBER OF RANDOM INTENSITY STORMS. Wyoming Univ., Laramie. Dept. of Geology; and Wyoming Univ., Laramie. Dept. of Statistics.
For primary bibliographic entry see Field 08B.
W72-03081

SPECTRAL COMPUTATIONS ON PRESSURE WAVE GAUGE RECORDS. Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 08B.
W72-03082

SHOALING OF FINITE-AMPLITUDE WAVES ON PLANE BEACHES. Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03098

PROBABILITIES OF BREAKING WAVE CHARACTERISTICS. Tetra Tech., Inc., Pasadena, Calif.
For primary bibliographic entry see Field 08B.
W72-03102

COMPUTER MODELLING OF DIFFRACTION OF WIND WAVES. California Univ., Berkeley.
For primary bibliographic entry see Field 08B.
W72-03106

DECISION MAKING UNDER UNCERTAINTY IN SYSTEMS HYDROLOGY. Arizona Univ., Tucson. Hydrology and Water Resources Interdisciplinary Program. D. R. Davis.
Arizona University Technical Reports on Hydrology and Water Resources, No 2, May 1971. 179 p, 11 tab, 140 ref, 3 append. OWRR B-007-ARIZ (18), Agreement 14-31-0001-3003.

Descriptors: *Decision making, *Hydrologic aspects, *Hydrology, *Hydraulic engineering, *Hydraulic design, Theoretical analysis, Model studies, Statistical methods, Systems analysis, Flood control, Design flood, Bridges, Erosion, Dams, Construction, Costs, Arizona.
Identifiers: *Systems hydrology.

Decision theory provides a rational method for making the decisions necessary for the design of hydrologic projects. The decision takes into account the economics of the project, the risks involved and the uncertainty in some of the parameters used. A measure of the added costs due to uncertainty is provided by calculating the expected opportunity loss. The advantage of decision theory, compared with other methods for evaluating the added costs due to uncertainty, is its ability to look at the specific case involved. Decision theoretic methods provide a way of measuring the value of new data, models, methods, etc. The value of anything which may cause a change in the decision can be measured. The literature of design theory is reviewed and the method is applied to the design of bridge piers and flood levees for Rillito Creek, Pima County, Arizona. (Woodard-USGS)
W72-03166

COLLECTIVE ADJUSTMENT OF THE PARAMETERS OF THE MATHEMATICAL MODEL OF A LARGE AQUIFER. Arizona Univ., Tucson. Hydrology and Water Resources Interdisciplinary Program.
For primary bibliographic entry see Field 02F.
W72-03167

THE ALLOCATION OF WATER RESOURCES PROJECTS METHODOLOGY: A MODEL FOR THE ALLOCATION OF FUNDS FOR THE DEVELOPMENT OF WATER RESOURCES. Oklahoma Univ., Norman. Bureau of Water Resources Research. George W. Reid, Joseph F. Lawrence, and Silas S. Y. Law.
Available from the National Technical Information Service as PB-205 803, \$3.00 in paper copy, \$0.95 in microfiche. Oklahoma Water Resources Research Institute, Research Project Final Report. 129 p, 34 fig, 18 tab, 11 ref. OWRR A-022-OKLA (1).

Descriptors: *Water resources development, *Benefits, *Regional analysis, *Resource allocation, *Future planning (Projected), *Optimum development plans, Long-term planning, Forecasting, Demand, Costs, Cost-benefit theory, Cost-benefit ratio, Decision making, Methodology, Budgeting.

The purpose was to analyze and evaluate the present methods used in the allocation of funds for water resource projects and to develop a more suitable method. A survey of water resource agencies indicated that two major problem areas, cen-

tering around measurement of all benefits in monetary terms and the viewing of projects as isolated entities, exist in the methods used to plan and evaluate water resource projects. An alternate method of allocation was then formulated. It was proposed that a needs model, based on predicted population and employment data, can be used to enumerate future regional water resource needs. After basin needs were determined, a basin level model was used to generate a set of allocations of funds for the development of each basin based on the minimization the differences between needs and development for a given budget, initial state of development, and time. A national level model was then utilized to allocate the federal water resource budget to the basins. The model output was a set of basin allocations for various levels of federal funding for a series of years. A test of the model was made which produced a feasible allocation of water resource development.
W72-03174

OPERATING GUIDELINES FOR MULTIPLE-PURPOSE RESERVOIRS. Missouri Univ., Columbia. A. T. Hjelmfelt, Jr.
Available from the National Technical Information Service as PB-205 806, \$3.00 in paper copy, \$0.95 in microfiche. Missouri Water Resources Center, Completion report OWRR A-036-MO (1), July 1, 1971. 30 p, 9 fig, 5 ref, 1 append.

Descriptors: *Reservoirs operation, Stochastic processes, Hydrology, *Water distribution, *Competing uses, Water supply.

Operating guidelines are used to allocate storage space and to allocate water to the various users. The several uses to which a multiple purpose reservoir is put are seldom of the same priority; so the water supplied to the users depend upon the amount available and the season of the year. In order to provide service to high priority users, the low priority users lose their service if it appears that there will be a shortage. The problem of ascertaining when the low priority user should lose service is investigated in this report. The method of P.A.P. Moran was modified to allow for demand from the reservoir to depend upon the amount of water in storage. A matrix approach was devised which allows for a fairly simple solution using library computer subroutines. The Moran method only considers flow into the reservoir at one time of the year and discharge from the reservoir at one other time of the year. The Gould modification considers continual inflow and outflow. The Gould method was modified to allow for seasonal variation of discharge from the reservoir, and to allow for variations of discharge with amount of water in storage.
W72-03186

COMPUTER SIMULATION OF WATER RESOURCE SYSTEMS AT UTAH STATE UNIVERSITY. Utah State Univ., Logan. College of Engineering. J. P. Riley.
Utah Water Research Laboratory, Occasional Paper No. 5, August 1970. 20 p, 9 fig, 10 ref. OWRR B-028UTAH (3).

Descriptors: *Model studies, *Hydrologic cycle, Digital computers, Analog computers, Hybrid computers, *Water resource development, Planning, *Simulation analysis.

The brochure gives a brief summary of the direction and scope of the computer simulation program in water resource systems at Utah State University. Basic concepts and techniques involved in the computer simulation of water resource systems are briefly discussed, and the development of this program is reviewed. Significant support for this program, particularly in the early stages, was derived from the Office of Water Resources Research under allotment and matching fund grants. Initially major emphasis was placed

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Group 6A—Techniques of Planning

on the development of general models of the hydrologic system, and the program has proceeded in stages to increasingly detailed models. Other dimensions subsequently have been added, such as those of water quality and economics, and attempts to include sociological considerations are now being followed. The broad and successful experience and the facilities available at Utah State University provide a basis for a sound and fundamental approach to water resource problems which are amenable to solution by computer simulation.

W72-03189

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
Iowa State Univ., Ames. Dept. of Civil Engineering.
M. D. Dougal, and E. R. Baumann.
American Water Resources Association, Proceedings of the Third Annual American Water Resources Conference, November 1967, p 242-253. 4 tab, 13 ref. OWRR A-001-IA (5).

Descriptors: *Mathematical models, *Optimization, *Biochemical oxygen demand, *Dissolved oxygen, *Water quality, *Waste water treatment, Digital computers, Data processing, Time, Regression analysis, Series analysis, Iowa.
Identifiers: *Monomolecular model.

The role of oxidation was reviewed and mathematical models which can express the progression of biochemical oxygen demand were evaluated. Laboratory results of studies of BOD progression of effluents from 3 types of secondary waste treatment processes including the standard-rate trickling filter, activated sludge and a waste stabilization pond showed that the monomolecular model failed to satisfy its fundamental assumptions. Two different mathematical models for BOD were developed and were statistically superior to the monomolecular model. Both models yielded greater values of ultimate oxygen demand than the monomolecular model thus suggesting that the ultimate value of BOD might be a useful indicator for selecting the model to adopt in practice. All the models with short-term data failed to predict accurately BOD long-term values, although the second model's prediction ability was superior within the period of observation. The study verified that the progression of BOD is not monomolecular but that the values of rate constant and total oxidizable matter vary uniformly with time. The study also showed that effluents will have a much lower rate constant than do untreated wastes. This may be useful in future studies of streamwater quality and in the determination of stream assimilative capacities. (Markell-Cornell)

W72-03196

ECOLOGICAL AND SYSTEMS PLANNING FOR THE GREAT LAKES,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
J. M. Armstrong, and J. T. McFadden.
Journal of Water Pollution Control Federation, Vol 43, No 12, p 2402-2413, December 1971. 6 fig, 1 tab.

Descriptors: *Ecological distribution, *Simulation analysis, *Great Lakes region, *Resource allocation, *Planning, Model studies, Optimization, Social aspects, Political aspects.
Identifiers: *Grand Traverse Bay.

The two major objectives of Michigan's Sea Grant program were: (a) the synthesis of existing limnological research and academic competence in an interdisciplinary institutional program that would function as a regional center of information and expertise; and (b) the development of a comprehensive, mission-oriented program that would provide a methodology for viewing the Great Lakes resources as a natural system, used and influenced by the broad spectrum of man's activities.

To achieve this objective a large-scale systems analysis project to develop predictive ecological models of the Great Lakes was begun. The research phase considered those problems stemming from the use of 6 major resource attributes of the Great Lakes, i.e. lake levels; water quality and circulation; flora and fauna; size, depth and minerals of basin; unique character and configuration of shoreline; and regional climate. The problems of these resource attributes were organized around 8 integrative systems functions. Predictive models were developed and used in the actual exploration of resource development alternatives. Gaming models and simulation models were proposed to investigate institutional interaction relative to rational use of the Great Lakes. A pilot study on the Grand Traverse Bay will be conducted to test the approach outlined. (Markell-Cornell)

W72-03197

DEVELOPMENT OF A SIMULATION MODEL FOR STORMWATER MANAGEMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
J. A. Lager, R. P. Shubinski, and L. W. Russell.
Journal of Water Pollution Control Federation, Vol 43, No 12, p 2424-2435, December 1971. 9 fig, 1 tab, 4 ref.

Descriptors: *Simulation analysis, *Computer models, *Storm runoff, *Sewerage, *Hydrographs, *Wastewater (Pollution), Management, Cost-benefit analysis, Routing, Cities.
Identifiers: *San Francisco, *Pollutograph, Fick's law.

To control pollution from combined sewer overflows, a comprehensive simulation model was developed (FORTRAN IV, plus statements) capable of representing both in quantity and quality urban stormwater runoff phenomena from the onset of precipitation on the basin, through collection, conveyance, storage, and treatment systems, to points downstream from outfalls which are significantly affected by storm discharges. The stormwater management model was subdivided into an executive block and four computational blocks. Hydrographs and "pollutographs" (time varying quality concentration or mass values) were generated for real storm events and systems from points in origin in real time sequence to points of disposal with user options for intermediate storage and/or treatment facilities. The quality constituents modeled were 5-day biochemical oxygen demand, total suspended solids, total coliforms, and dissolved oxygen. Both combined and separate sewerage systems were evaluated using dry-weather flow routines. Cost routines applied to water quality assisted in the direct cost-benefit analysis of alternate programs of water quality improvement. Verification of computed results against measured data were given for the Baker St. combined sewer basin in San Francisco. It was concluded that complete sewer separation was not justified. (Markell-Cornell)

W72-03198

SYSTEMS ANALYSIS IN WATER RESOURCES PLANNING.
Meta Systems Inc., Cambridge, Mass.

Available from the National Technical Information Service as PB-204 374, \$6.00 in paper copy, \$0.95 in microfiche. Report NWC-EES-71-018, July 1971. 393 p, 17 fig, 27 tab. NWC 71-015.

Descriptors: *Systems analysis, *Water resources planning, *Mathematical models, OPERATIONS RESEARCH, Optimization, Simulation analysis, Analytical techniques, Model studies.

By means of a study on the use of systems analysis in water resources planning processes the potential role of this approach is described for water resource planners. Emphasis is placed on the fact that the systems approach is not limited to the

analysis of formal mathematical models. This history of and opportunity for the applications of the systems approach to water resource problems are discussed. Characteristics of water resource systems and their implications for systems approaches in planning is examined. Both prescriptive and descriptive mathematical modeling techniques associated with the systems analysis approach are discussed. Some modeling techniques which have seen frequent application in water resource planning are discussed in detail. A number of data and analysis issues are explored using simple didactic examples. Case discussions of systems studies are presented. (NWC)

W72-03290

DIGITAL SIMULATION OF GROUNDWATER SYSTEMS,
Scientific Software Corp., Denver, Colo. Technological Center.
E. A. Breitenbach.
Simulation of Water Resources Systems, (Symposium). Nebraska Water Resources Research, Institute, Lincoln, July 18-23, 1971. 59 p. OWRR A-999-NEB (4).

Descriptors: *Digital computers, *Simulation analysis, *Ground water systems, *Darcy's law, *Mathematics, Dupuit-Forchheimer theory, Analog models, Approximation method.

A survey of digital simulation models of ground water systems is presented. Basic equations for ground water flow, including Darcy's Law, unsteady state of saturated flow equation and unsteady state partially saturated flow equations were derived from the principles of conservation of mass. Mathematical techniques were used to obtain analytic solutions of the different equations included Fourier Series, Laplace Transforms, transformation of variables, conformal mapping and graphical approximation. A few examples of analog solutions were given. A description of analog solutions to ground water problems included sand, viscous fluid, electric and membrane models. Numerical solutions included finite difference forms, finite difference form of the saturated flow equation, the matrix problem (implicit solutions), and matrix solution techniques. Data requirements were listed for digital or electric analogs. (Markell-Cornell)

W72-03300

SIMULATION MODELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
F. E. Perkins.
In: Simulation of Water Resources Systems, (Symposium). Nebraska Water Resources Research Institute, Lincoln, July 18-23, 1971. 14 fig, 7 tab, 19 ref, 3 append. OWRR A-999-NEB (4).

Descriptors: *Simulation analysis, *Computer models, *Water resources, *Digital computers, *Flood control, *Puerto Rico, Rainfall simulator, Channel flow.
Identifiers: *Manati River, *Catchment-runoff.

This paper discussed simulation models relative to water resources problems, the rationale for using simulation models, e.g. cost of data, complexities of description, mathematical limitations, model objectives, limitations, the processes necessary for achieving simulation (conceptualization, implementation and operation) and the components of simulation models such as inputs, physical constraints, nonphysical constraints, operating rules and outputs. A simulation model was developed and applied to a study of flood control measures on the Manati River in Puerto Rico. The model used was essentially a digital computer analog of physical processes governing the occurrence of rainfall and its transformation by a catchment into river flows and floods. Three major elements made up the model: rainfall statistics, catchment parameters and channel parameters. Each of the components was tested and verified independently.

dently. A brief review of other simulation models was included. Appendix A gave a detailed description of the rainfall simulator, Appendix C described the catchment-runoff model. A detailed description of the flood stage simulator was given in Appendix E. (Markell-Cornell)
W72-03301

NUMERICAL METHODS,
Missouri Univ., Rolla. Dept. of Civil Engineering.
T. E. Harbaugh.

In: Simulation of Water Resources Systems, Nebraska Water Research Institute, Lincoln, July 18-23, 1971. 41 p, 19 fig, 2 tab, 31 ref, append. OWRR A-999-NEB (4).

Descriptors: *Statistical methods, *Probability, *Hydrologic data, *Markov processes, *Sequential generation, Variability, Distributions, Water resources, Routing, Flow.
Identifiers: *St. Venant, *Newton's iteration.

The mechanics of the unsteady flow of water were mathematically expressed in terms of the St. Venant equations. These equations were simplified for application to typical problems in open channel flow. Numerical methods for calculating the initial state of a river reach for use in a hydraulic routing technique were discussed. Differential equations and Newton's iteration technique expressed the gradually varied flow. A river routing problem was illustrated. (Markell-Cornell)
W72-03302

STATISTICS, PROBABILITY THEORY, STOCHASTIC TIME SERIES, GENERATION OF HYDROLOGIC DATA,

Virginia Military Inst., Blacksburg. Dept. of Civil Engineering.
John W. Knapp.

In: Simulation of Water Resources Systems, Nebraska Water Resources Research Institute, Lincoln, July 18-23, 1971. 55 p, 19 fig, 2 tab, 31 ref, append. OWRR A-999-NEB (4).

Descriptors: *Statistical methods, *Probability, *Hydrologic data, *Markov processes, *Sequential generation, Variability, Distributions, Water resources, Routing, Flow.

The paper covered statistics, concepts of probability, stochastic time series, generation of hydrologic data. Statistical methods were presented which are used to describe hydrologic data such as rainfall depths and intensities, peak annual discharge, flood flows, low flow durations, etc. Basic concepts of probability, e.g. random variables and continuous variables, were defined and types of probability distributions, e.g. straightforward plotting and frequency factors described. The means for determining reliability of statistical and frequency studies were discussed. Also, hydrologic processes involving multiple variables and joint probability distributions were presented, e.g. multivariate distribution, regression theory, Markov chains, stochastic time series. Methods for generating the historical trace sequences were described. (Markell-Cornell)
W72-03303

ECONOMIC ASPECTS OF WATER RESOURCES SYSTEMS,
Nebraska Univ., Lincoln.

M. Gysi.
In: Optimal Analysis of Water Resources Systems, (Symposium), Nebraska Water Resources Research Institute, Lincoln, July 25-30, 1971. 89 p, 26 fig, 15 ref. OWRR A-999-NEB (5).

Descriptors: *Dynamic programming, *Optimization, *Water resources, *Economics, *Economic efficiency, Water demands, Mathematics, Model studies, Cities.

This paper presented a hypothetical dynamic programming model for optimally meeting

metropolitan water demands and determining an optimum pricing schedule. Dynamic programming offered an efficient method for determining the optimal expansion path (size and timing of capacity increases from the large number of feasible expansion paths). Basic economic concepts used in structuring the model such as demand curves, aggregate and marginal values in use and community surplus were discussed. A description of economic principles for efficient water pricing was included. Current and proposed alternative policies were described and a defense of incremental block or conservation pricing given. The system capacity based on the short-run marginal production cost curve was given, followed by a derivation of the cost function used in the main hypothetical model. The objective was to maximize the present value of future marginal net consumer surpluses plus producer revenues for a given pricing policy. The program objective was achieved. (Markell-Cornell)
W72-03304

LINEAR PROGRAMMING,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. H. Marks.

In: Optimal Analysis of Water Resources Systems, Nebraska Water Resources Research Institute, Lincoln, July 25-30, 1971. 149 p, 10 fig, 61 ref, 4 append. OWRR A-999-NEB (5).

Descriptors: *Optimization, *Linear programming, *Mathematical models, *Water resource development, *Water reuse, *Economic efficiency, Waste water treatment, Computer programs, Dynamic programming, River Basin development.
Identifiers: Rio Colorado Basin.

This paper discussed optimization and linear programming theory and the application of linear programming in water resource systems. Discussed were algebraic and geometric representations of linear programming, geometric and algebraic interpretation. Duality and sensitivity analysis were discussed. A section on simple approximation was included. Transportation and network flow problems were given and computer programs suggested for solution. Three case studies were presented. Study One developed water supply resources including water reuse to meet anticipated water demands; Study Two used a simple model to find a regional least cost combination of treatment alternatives that will satisfy quality standards; Study Three used a simple screening model for large scale water resource development in a totally undeveloped region. Linear programming screening models were used to investigate preliminary selection of sites and operating strategies for development in a complex river basin system. Also, a dynamic investment model for planning the development of a river basin was presented. The third section briefly considered some approaches to non-linear problems. A general non-linear problem with constraints added was given. Numerous solution techniques were noted. Finally, a dynamic programming problem was presented. (Markell-Cornell)
W72-03305

6B. Evaluation Process

PROBLEMS AND OPPORTUNITIES OF WATER RESOURCE UTILIZATION IN THE UPPER COLUMBIA AND MISSOURI BASINS,
Montana State Univ., Bozeman. Water Resources Research Center.
R. J. McConnen.

Available from the National Technical Information Service as PB-205 608, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Montana Water Resources Research Center, Bozeman, 15 p, (n.d.), 1 tab. OWRR A-009-MONT (1).

Descriptors: *Systems analysis, *Computer programs, *Linear programming, *Resource allocation, *Water management, *Industrial water, Montana, Water requirements.
Identifiers: Water use survey, *Gallatin Valley (Mont).

This project consisted of two independent studies. The first was a case study of the water management problems in the Gallatin Valley, Montana. The second was primarily a survey of industrial water use in the state of Montana. The systems analysis approach was used in the Gallatin Valley study; system boundaries defined, interacting variables identified, and reasonable parameter values determined. The linear programming format was selected on the basis that the Gallatin Valley water system has an approximately linear response. The basic objective of the survey was to record all water use by industry sources and to estimate future needs of industry. The survey asked firms to list their total water intake by source, to estimate their consumptive use, to state their value and volume of production, to indicate their water quality requirements and to make projections of their probable water intake in future years. (Holje-Montana)
W72-03146

THE ALLOCATION OF WATER RESOURCES PROJECTS METHODOLOGY: A MODEL FOR THE ALLOCATION OF FUNDS FOR THE DEVELOPMENT OF WATER RESOURCES,

Oklahoma Univ., Norman. Bureau of Water Resources Research.
For primary bibliographic entry see Field 06A.
W72-03174

A STATE OF THE ARTS STUDY OF PUBLIC PARTICIPATION IN THE WATER RESOURCES PLANNING PROCESS,
Michigan Univ., Ann Arbor. School of Natural Resources.
K. P. Warner.

Available from the National Technical Information Service as PB-204 245, \$3.00 in paper copy, \$0.95 in microfiche. Report NWC-SBS-71-013, July 1971. 235 p, 18 fig, 81 ref, 2 append.

Descriptors: *Water resources planning, Planning, Surveys, Social participation, Social values.
Identifiers: *Public participation.

The Report reviews public participation activities and procedures which have been utilized in connection with governmental planning studies, particularly those dealing with water resources. Key dimensions focused on include: identification of the public; functions and objectives for participatory activities; mechanisms for securing public involvement; and timing of participation within the planning process. A model for a participatory planning process is also proposed. Results from an extensive questionnaire survey of State, regional and local planning agencies and of environmentally-oriented citizens groups are presented. The questionnaires dealt with types of participatory activities undertaken, how these were evaluated in terms of results achieved, past and future roles for public participants, and changes needed to make participatory planning efforts more effective. Key problems and issues affecting participatory planning are also discussed. These include securing adequate public involvement; appropriate responsibilities in the planning process; and resolution of conflicts between interests. A series of recommendations for agency program and institutional arrangement changes are included in the final chapter. (NWC)
W72-03292

HYDROELECTRIC POWER POLICY,
National Water Commission, Arlington, Va.
T. P. Price.

Available from National Technical Information Service as PB-204 052, \$3.00 in paper copy, \$0.95

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Group 6B—Evaluation Process

in microfiche. Report NWC-SBS-71-012, February 1971. 58 p, 4 fig, 2 tab, 32 ref.

Descriptors: *Hydroelectric power, *Hydroelectric project licensing, *Environment, *Water policy, *Energy, Public rights, Water resources development, Federal project policy, Federal Power Act, Power marketing, Transmission (Electrical), Forecasting, Conservation, Non-consumptive use.

Identifiers: Preference clause, Partnership.

Brief background and analysis of the more significant public policy issues related to hydroelectric power development are presented. The historic issues examined are (1) public vs. private development of sites, (2) 'preference clause', (3) Federal transmission policy, (4) Federal rates policy, (5) headwater benefits and (6) 'partnership' development. The emerging issues examined are (1) environmental quality, (2) project delay and (3) project relicensing or takeover. The report contains staff recommendations on the issues examined. (NWC)

W72-03295

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC ASPECTS OF WATER RESOURCES SYSTEMS,

Nebraska Univ., Lincoln.

For primary bibliographic entry see Field 06A.

W72-03304

6D. Water Demand

PROBLEMS AND OPPORTUNITIES OF WATER RESOURCE UTILIZATION IN THE UPPER COLUMBIA AND MISSOURI BASINS, Montana State Univ., Bozeman. Water Resources Research Center.

For primary bibliographic entry see Field 06B.

W72-03146

GEOLOGY AND WATER RESOURCES OF BON HOMME COUNTY, SOUTH DAKOTA, PART II; WATER RESOURCES,

Geological Survey, Huron, S. Dak.

For primary bibliographic entry see Field 03F.

W72-03153

EFFECTS OF IRRIGATION ON STREAMFLOW IN THE CENTRAL SAND PLAIN OF WISCONSIN,

Geological Survey, Madison, Wis. Water Resources Div.

For primary bibliographic entry see Field 04B.

W72-03165

A WATER AND RECREATION STUDY OF THE BLACKFOOT RIVER SYSTEM, MONTANA,

Montana Univ., Bozeman. Joint Water Resources Research Center.

C. Malouf.

Available from NTIS as PB-205 822, \$3.00 in paper copy, \$0.95 in microfiche. Report No. 1, Institute for Social Science Research, University of Montana, Missoula, Montana, November 1969. 8 p, 1 fig. OWRR A-030-MONT (1).

Descriptors: *Recreation, *Attitudes, *Use rates, *Social participation, Montana, River systems, Recreation facilities.

Identifiers: Blackfoot River System (Mont).

The purpose of this study was to determine the recreational uses of the lower portion of the Blackfoot River system in western Montana. Only the lower portion has been investigated in detail, but plans are being made to continue similar and comparative studies in the middle and upper sec-

tions as well. Until all sections have been fully investigated the present phase must be regarded as preliminary. The primary objectives were initially directed at determining the recreational uses of the water flowing through the Blackfoot River drainage. Specifically, the goals were listed as: (1) To determine the recreational uses of portions of the river course and the lakes. (2) To determine the origin of residence and other data about persons who used the recreational sites, facilities and resources. (3) To determine the extent of changes in use during the four seasons of the year. (4) To determine or discover new uses for the area, and to appraise its recreational potential for the future. (Holje-Montana)

W72-03297

WE ARE NOT RUNNING OUT OF WATER,

G. E. Symons.

Water and Wastes Engineering, Vol 7, No. 9, September 1970, p E/16-E/22, 2 tab.

Descriptors: *Water supply, *Water demand, *Consumptive use, *Water reuse, Population, Industry, Agriculture, Precipitation, Runoff, Rivers, Reservoirs, Evapotranspiration control.

Identifiers: Per capita use factor, Population control.

In approaching the question of adequate water supply, many writers and speakers have compared the total water needs with the amount of water available from stream flow. This comparison has always been based on the 'total withdrawal use' as defined by the USGS, with the available supply calculated from stream flow. Unfortunately, the application of a nation-wide average value is not the simple answer. The sound bases for estimates and projections include: (1) regional approach to avoid national averages; (2) population growth rates must be based on current trends rather than projections of historical curves; (3) the terms total water use and 'water availability' must be re-examined and redefined to avoid confusion with total water requirements and true availability; (4) water reuse and salt water conversion must be considered; and, (5) the per capita use factor for fresh water should be evaluated in terms of true use of consumption. When the actual consumption of water is considered, it is apparent that even under current population growth and increases in per capita consumption, fresh water needs for consumptive uses will not overtake the assured availability before 2015. If both population growth and consumption rates are controlled to an average of 1 percent a year, the actual water requirements for consumptive uses will be only 75% of the available supply in 2020. Some areas of the country are short of water. The answer to the problem of the semi-arid regions lies in either water modification or basin transfer. (Goessling-Texas)

W72-03370

6E. Water Law and Institutions

THE LAW OF WATER IN NEW JERSEY: GROUNDWATER - PART II,

Rutgers-The State Univ., New Brunswick, N.J.

Eva H. Hanks, and John L. Hanks.

Rutgers Law Review, Vol. 24, No. 4, p 621-671, Summer 1970. OWRR A-001-NJ (4).

Descriptors: *Water law, *Water rights, *Legal aspects, Judicial decisions, Overlying proprietor, Riparian rights, Unappropriated water, Water courses (Legal), New Jersey.

Identifiers: American rule of groundwater, Correlative rights doctrine, Prior appropriation.

Legal aspects of the use and allocation of groundwater in N.J. are described, including the physical situation in the State, categories and definitions, four rules of law governing groundwater, New Jersey cases, and private groundwater pollution controversies. Certain language in the trading case supports the claim that New Jersey follows the

'American rule' of reasonable use; but there are other indications that the correlative rights doctrine prevails. However, some rule other than prior appropriation may be found to apply to transporters and merchandisers. Only our groundwater pollution case of importance has been denied in New Jersey and in that case the court applied nuisance criteria. The question of trespass in groundwater pollution cases has not been faced. (Whipple-Rutgers)

W72-03190

INSTITUTIONAL ARRANGEMENTS: RIVER BASIN COMMISSIONS, INTER-AGENCY COMMITTEES, AND AD HOC COORDINATING COMMITTEES,

National Water Commission, Arlington, Va.

G. W. Hart.

Available from National Technical Information Service as PB-204 244, \$3.00 in paper copy, \$0.95 in microfiche. Report NWC-L-71-017, September 1971. 127 p, 14 ref, 5 append. Legal Studies 13b, 13c, 13d, 13e.

Descriptors: *Institutions, *Planning, *River basins, *River basin commissions, Institutional constraints, Inter-agency cooperation, Water resource development, River basin development.

Identifiers: Water resources planning institutions.

River basin commissions and federal-state ad hoc and interagency committees are described and analyzed; their strengths and weaknesses are evaluated, and recommendations for improving these institutions are made. (Liebman-NWC)

W72-03291

A STATE OF THE ARTS STUDY OF PUBLIC PARTICIPATION IN THE WATER RESOURCES PLANNING PROCESS,

Michigan Univ., Ann Arbor. School of Natural Resources.

For primary bibliographic entry see Field 06B.

W72-03292

THE NEW ENGLAND RIVER BASINS COMMISSION, A CASE STUDY LOOKING INTO THE POSSIBILITIES AND DISABILITIES OF A RIVER BASIN COMMISSION ESTABLISHED UNDER TITLE II OF THE WATER RESOURCES PLANNING ACT OF 1965,

National Water Commission, Arlington, Va.

H. Ingram.

Available from the National Technical Information Service as PB-204 375, \$3.00 in paper copy, \$0.95 in microfiche. Report NWC-SBS-71-019, November 1971. 64 p, append.

Descriptors: *River basins, *Planning, Water resources planning, Federal Government, State Government, River basin commissions.

Identifiers: *Joint Federal-State Planning Organizations, *Inducements, Persuasion, Strategy and actions.

'What difference do River Basin Commissions make' is the key question addressed here, and the New England River Basins Commission is the case study. Interviews provide an important part of the data. The study assumes a relationship between what an organization does and the inducements it offers participants. Support for individual goals, defense of various missions, avoidance of conflict, collection of information, etc., are inducements to the Chairman and staff, federal agencies, states, interest groups and others. Among participants, only the Chairman and staff have a primary stake in a commission and a commitment to make it work. Chairmen have certain limited resources to persuade others to work through River Basin Commissions. The strategy and actions of the N.E.R.B.C. reflects the possibilities and disabilities present in such organizations. The study concludes that River Basin Commission, with skilled leadership, serve a facilitating function which links common interest. (NWC)

W72-03293

RESOURCES DATA—Field 07

Data Acquisition—Group 7B

METROPOLITAN WATER INSTITUTIONS: LEGAL AND GOVERNMENTAL STRUCTURES FOR WATER MANAGEMENT IN METROPOLITAN AREAS, National Water Commission, Arlington, Va. E. Delogu.
Available from National Technical Information Service as PB-204 051, \$3.00 in paper copy, \$0.95 in microfiche. Legal Study No. 16. Report NWC-L-71-016, July 1971. 86 p.

Descriptors: *Cities, *Metropolitan, *Water supply, *Institutions, Urban areas, Municipalities, Regions, Water resources development, Waste disposal, Management.
Identifiers: *Metropolitan water institutions, *Regional water institutions.

Existing water supply and waste water treatment problems in metropolitan areas, and institutions dealing with them, are discussed. New approaches and institutions for metropolitan water management are suggested including the establishment of new metropolitan water quality control regions, massive federal financial incentives, and direct federal assumption of metropolitan water supply and waste water treatment responsibilities. (Liebman-NWC)
W72-03294

HYDROELECTRIC POWER POLICY, National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06B.
W72-03295

07. RESOURCES DATA

7A. Network Design

HYDROLOGIC ANALYSIS, NORTH FORK ELK CREEK, Montana State Univ., Bozeman. Water Resources Research Center.
Richard Konizeski.
Available from the National Technical Information Service as PB-205 607, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, 16 p., (n.d.). OWRR A-008-MONT (1).

Descriptors: *Hydrologic budget, *Streamflow, *Water measurement, *Precipitation, *Watersheds (Basin), *Hydrologic data, Montana, Networks.
Identifiers: *North Fork Experimental Watershed (Mont).

The purpose was to establish an instrument network for calibrating the North Fork Experimental Watershed. The watershed was previously designated by the School of Forestry as an outdoor hydrologic laboratory. Three major components of the hydrologic budget are emphasized in this study: (1) precipitation, (2) streamflow, and (3) groundwater discharge. A network of twenty-five rain gages, both recording and non-recording were used to determine precipitation intensity and distribution. The isohyetal and arithmetic methods for areal averaging of precipitation were compared. A comparison was also made of radar precipitation estimates with the precipitation records. Three Parshall flumes with recording gages were installed to obtain streamflow records. The quantity of groundwater discharge from the watershed was determined by the discharging well method. (Holje-Montana)
W72-03145

CHEMISTRY OF NATURAL WATERS -- VI. CLASSIFICATION OF WATERS, National Inst. for Water Research, Congella (South Africa). Regional Lab.
P. H. Kemp.
Water Research, Vol 5, No 10, p 943-956, October 1971. 3 fig, 5 tab, 18 ref.

Descriptors: *Water chemistry, *Natural streams, *Chemical analysis, *Water analysis, *Analytical techniques, Dissolved solids, Electrical conductance, Water properties, Conductivity, Biochemical oxygen demand.
Identifiers: *Natal (South Africa).

A scheme is proposed for standardizing water analyses to make them directly comparable despite differences in TDS. This utilizes the molar concentrations of the acids and bases considered to be dissolved in the water and leads to a convenient diagrammatic representation of water analyses. Comparison of Natal, South Africa river waters by this means shows that they possess various features in common and can be grouped together in a series of chlorided waters. Rain water and sea water also fit into this series, as do many American river waters. It is often useful to consider the probable utility of the water, and a broad assessment of this can be obtained from knowledge of the electrical conductivity of the water and the BOD. Taking into account various accepted specifications for water for particular uses, a scheme of classification of waters into five classes according to probable utility is proposed. This has a simple statistical basis and can be adapted, with scant loss in precision, for use where only a few samples of water have been studied. The classification leads to a clear and consistent picture of the present water sources of Natal. (Woodard-USGS)
W72-03168

CHEMISTRY OF NATURAL WATERS -- V. HARDNESS, National Inst. for Water Research, Congella (South Africa). Regional Lab.
For primary bibliographic entry see Field 02K.
W72-03169

DETERMINATION OF THE PERMEABILITY COEFFICIENT OF PEAT SOIL (OB OPREDELENII Koeffitsiyenta Fil'trat-SII TORFYANOY POCHVY), Moskovskii Inzhenerno-Stroitelnyi Institut (USSR).
For primary bibliographic entry see Field 02G.
W72-03243

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 05A.
W72-03282

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG, Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 05A.
W72-03286

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION, Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 05A.
W72-03287

7B. Data Acquisition

SUBSURFACE AND SURFACE SAMPLING OF BENTHIC INVERTEBRATES IN TWO STREAMS, Calgary Univ. (Alberta). Dept. of Biology.
D. S. Radford, and R. Hartland-Rowe.

Limnol Oceanog. 16 (1): 114-120. Illus. 1971.
Identifiers: Benthic, Invertebrates, Method, Sampler, Sampling, Streams, Subsurface, Surface.

A new subsurface sampling technique for collecting macroinvertebrates in gravel bottom streams is described. The cylinder sampler collects all species whose presence is indicated by a Surber sampler, but the percentage composition of the population sampled is different. With this method, a far larger number of benthic invertebrates is obtained making it possible to reduce the number of samples to 10 or less and yet obtain estimates within 20% of the true mean of the benthic invertebrate population inhabiting the top of 17.5 cm of substrate. --Copyright 1971, Biological Abstracts, Inc.
W72-03049

RESULTS OF APPLICATION OF HEAVY WATER (D20) BY SOVIET AND FOREIGN RESEARCHERS IN THEIR STUDY OF WATER IN PLANTS, CLAY MINERALS AND SOIL (OB OPYTE PRIMENENIYA TYAZHELOY VODY (D20) SOVETSKIMI I ZARUBEZHNYMI ISSLEDOVATELYAMI PRI IZUCHENII VLAGI V RASTENIYAKH, GLINISTYKH MINERALAKH I POCHVE), Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
V. Ya. Bondareva.
Pochvovedeniye, No 3, p 137-143, March 1971. 2 tab, 34 ref.

Descriptors: *Reviews, *Publications, *Foreign research, *Soil-water-plant relationships, *Heavy water, Deuterium, Tracers, Tagging, Soils, Soil water movement, Water properties, Diffusion, Plants, Plant physiology, Root systems, Nutrients, Mineralogy, Clay minerals, Analytical techniques.
Identifiers: *USSR, Water behavior, Water exchange, Labeling, Diffusion coefficients, Interferometers.

Results of a number of Soviet and foreign investigations conducted in the 1950's and 1960's on the use of heavy water (D20) as a tracer to study the behavior of natural water in soil, plants, and clay minerals are briefly reviewed. The reason for using heavy water as a tracer lies in its peculiar properties: (1) it is easily determined quantitatively at very low concentrations; (2) it is not selectively adsorbed by the soil; and (3) it does not produce insoluble compounds. Its experimental use as a tracer in various branches of the natural sciences, including biology, medicine, chemistry, hydrogeology, and geology, may have future application and deserves careful study both from the methodological and practical standpoint. Use of heavy water will permit more detailed investigations of the behavior of water in the soil and of such genetic problems as exchange capacity of the soil and the behavior of readily soluble salts in it. (Josefson-USGS)
W72-03070

DIRECTIONAL SPECTRA FROM WAVE-GAGE ARRAYS, California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03085

WAVE FORECASTING FOR THE WEST COAST OF INDIA, Karnataka Regional Engineering Coll., Surathkal (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03089

COMPILATION OF OCEAN AND LAKE WAVE STATISTICS, Coastal Engineering Group, Los Angeles, Calif.
For primary bibliographic entry see Field 08B.
W72-03090

Field 07—RESOURCES DATA

Group 7B—Data Acquisition

MACRO-TURBULENCE FROM WIND WAVES,
Tri-State College, Angola, Ind. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03091

ENERGY LOSSES UNDER WAVE ACTION,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03093

HORIZONTAL WATER PARTICLE VELOCITY OF FINITE AMPLITUDE WAVES,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03096

A SYSTEM FOR MEASURING ORBITAL VELOCITIES IN WAVES,
Pan American Petroleum Corp., Tulsa, Okla.
For primary bibliographic entry see Field 08B.
W72-03097

WATER SURFACE TEMPERATURE MEASUREMENT USING AIRBORNE INFRARED TECHNIQUES,
Barnes Engineering Co., Stanford, Conn. Remote Sensing Dept.
For primary bibliographic entry see Field 02H.
W72-03127

DATA PREPARATION FOR WATER RESOURCE STUDIES,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02H.
W72-03129

A SUBMERSIBLE SELF-CONTAINED WATER QUALITY METER,
Plessey Co., Ltd., Ilford (England). Environmental Sensor Div.
For primary bibliographic entry see Field 02H.
W72-03130

UNDERWATER TIME-LAPSE MOTION PICTURE SYSTEMS,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W72-03157

THE APPLICATION OF GEOPHYSICAL INSTRUMENTS AND PROCEDURES TO GROUND WATER EXPLORATION AND RESEARCH,
Montana Univ., Bozeman. Joint Water Resources Research Center.
John P. Marshall.
Montana Water Resources Research Center. Termination report (1971). 5. OWRR A-013-MONT (1).

Descriptors: *Groundwater, *Seismograph, *Resistivity, *Geologic conditions, *Aquifer instrumentation.

There are many types of portable and mobile instruments that may be utilized in the exploration for ground water. Portable instruments checked were a Terrascout (oscilloscope-type) seismograph and resistivity equipment. Optimum conditions for successful use of these instruments relate to shallow, well defined layers of rock or earth material and to relatively pure ground water for resistivity studies. Where surface over-burden has similar seismic velocity to an underlying shale bedrock and the ground water is low in resistance, neither instrument gives good results. In any event, a knowledge of geologic conditions is advisable or necessary, and instruments should be

check-operated under known conditions at first. Large mobile seismic equipment is useful in determining the potential volume of a ground-water reservoir but will not give any determination of whether the reservoir (aquifer) will or will not yield useable amounts. Seismic refraction shots in the upper Silver Bow (Butte) Valley of Montana, when correlated with a gravity profile, proved the fault block nature of the valley and showed a maximum depth of 880 feet to bedrock. Results of the study utilizing a large seismograph were not conclusive, because the study was terminated before a combination of refraction and reflection shots was attempted. (Holje-Montana)
W72-03185

THE CSIR 'DOORSTOPPER' AND TRIAXIAL ROCK STRESS MEASURING INSTRUMENTS,
National Mechanical Engineering Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 08E.
W72-03199

APPLICATION OF INSTRUMENTATION TO EARTH DAMS,
Rofe, Kennard and Lapworth, London (England).
For primary bibliographic entry see Field 08D.
W72-03202

NEW METHOD FOR DETERMINATION OF TENSILE STRENGTH OF SOILS,
Lehigh Univ., Bethlehem, Pa.
For primary bibliographic entry see Field 08D.
W72-03209

ESTIMATING EUTROPHIC POTENTIAL OF POLLUTANTS,
Monsanto Co., St. Louis, Mo; and Washington Univ., St. Louis, Mo. Dept. of Environmental and Sanitary Engineering.
For primary bibliographic entry see Field 05C.
W72-03218

LYSIMETER METHOD OF DETERMINING THE PERMEABILITY COEFFICIENT OF MANTLE LOAM (LIZIMETRICHESKIY METOD OPREDELENIYA KOEFFITSIYENTA FIL'TRATSII POKROVNOYKH SUGLINKOV),
Ministerstvo Geologii, Tashkent (USSR).
For primary bibliographic entry see Field 02G.
W72-03244

AN INSTRUMENT FOR MEASURING THE ELECTRICAL CONDUCTIVITY OF SEA WATER FROM SHIPBOARD,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
V. A. Aranson, Yu. M. Gusev, and B. V. Shekhvatov.
Oceanology (USSR), Vol 11, No 2, p 258-262, November 1971. 5 fig, 2 tab.

Descriptors: *Instrumentation, *Electrical conductance, *Conductivity, *Sea water, *Measurement, Fluctuation, Electrodes, Waves (Water), Water temperature, Turbulence, Ships.
Identifiers: *USSR, *Black Sea, *Electrical conductivity.

In 1968 the Experimental Engineering Section of the P.P. Shirshov Institute of Oceanology, USSR Academy of Sciences, developed and built an instrument to measure the average value and fluctuations of electrical conductivity of sea water. The measurement range is 10-40% at temperatures of 0-30 deg C and depths to 500 m. Measurements, which can be made with the ship at drift or underway, make it possible to obtain profiles of the conductivity fluctuation field over large areas. The technical characteristics of the conductivity-measuring instrument permit conductivity variations in space and time to be studied to the smallest scales of 2 cm and 0.005 sec, respectively. The spatial

resolution may be further improved by decreasing the electrode size. Experimental tests in the Black Sea in 1968 showed that the electrical conductivity field in the upper 100-m layer was complex: the vertical gradients varied with depth, and the horizontal structure of the field had weakly correlated inhomogeneities with linear dimensions of 2.5 cm to 3 m and 10-15 m. The vertical gradients are apparently attributable to small-scale turbulence, while the fluctuations seemingly stem from internal waves. (Josefson-USGS)
W72-03245

THE ACCURACY OF ESTIMATES OF AREAL MEAN RAINFALL,
Otago Univ., Dunedin (New Zealand) Dept. of Geography.
For primary bibliographic entry see Field 02B.
W72-03261

A NEWLY DEVELOPED GROUNDWATER LYSIMETER FOR MEASURING EVAPOTRANSPIRATION FROM DIFFERENT GROUNDWATER LEVELS IN A SMALL CATCHMENT AREA OF THE NORTH GERMAN COASTAL REGION,
Kiel Univ. (West Germany).
U. Schendel.

In: Symposium on the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 639-645, 1970. 1 fig, 1 tab, 5 ref.

Descriptors: *Evapotranspiration, *Groundwater, *Lysimeters, Evaporation, Flood plains, Percolation, Infiltration, Water balance, Surface-groundwater relationships.
Identifiers: *Groundwater lysimeter.

A new groundwater lysimeter allows the measurement of evapotranspiration from the groundwater table and the capillary zone just above the groundwater down to a depth of 180 cm. Two groundwater lysimeters planted with grass were used to determine the water balance of a small catchment area of the north German coastal region bordering the North Sea. Evapotranspiration from soil moisture and the groundwater was determined separately. The groundwater table in the lysimeters was adjusted to the natural groundwater table. With 799 mm of rainfall, total evapotranspiration amounted to 520 mm, of which 289 mm (56 percent) accounted for withdrawal from the soil moisture zone and 231 mm (44 percent) from the groundwater and the capillary zone. At the same time water balance of the total catchment area was determined. (See also W72-03247) (Knapp-USGS)
W72-03277

A RATIONAL APPROACH TO GROUNDWATER INVESTIGATIONS IN REPRESENTATIVE BASINS,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02F.
W72-03279

DETERMINATION OF UREA IN BLOOD AND URINE WITH A UREA-SENSITIVE ELECTRODE,
Louisiana State Univ., New Orleans. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W72-03288

APPLICATIONS OF RADIOISOTOPES AND RADIATION SOURCES IN INDUSTRY, RADIATION PROCESSING AND HYDROLOGY - CURRENT STATUS IN INDIA,
Bhabha Atomic Research Centre, Trombay (India).
V. K. Iya, A. C. Eapen, and K. Krishnamurthy.

Available from the National Technical Information Service as A/CONF.49/P/539, \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/539, May 1971, 20 p. 2 fig, 1 tab, 29 ref.

Descriptors: *Radioactive isotopes, *Radioactive dating, *Tagging, *Tracers, *Tracking techniques, *Water pollution sources, Public health, Waste dilution, Water pollution, Water quality control, Hydrology, Water quality, Water treatment, Sub-surface waters, Coasts, Harbors, Pollutant identification, Waste treatment, Tritium, Carbon. Identifiers: Pollution parameters, Concentration, Quantification, Silicon.

Radioisotope tracer techniques have been used in India on a wide scale to study and solve a number of problems in the field of hydraulics and hydrology. The studies were carried out mainly to obtain specific information and understanding of the problem or process in question rather than to examine the full scope of the technique. However, where existing methods proved unsatisfactory, methods were developed to extend the use of accepted techniques. The investigations carried out to study the movement of sediment transport, the seepage in dams and canals, and flow measurement in turbines and turbulent streams are briefly summarized. Besides the nuclear techniques aimed at solving localized hydrological problems, considerable effort has been made to develop and use isotope techniques in dating ground waters and studying the distribution of bomb-tritium and the cosmic carbon-14 and silicon-32. (Houser-ORNL) W72-03316

PROGRESS IN APPLICATION OF NUCLEAR TECHNIQUE IN GEOPHYSICS, MINING, AND HYDROLOGY IN POLAND,
Institute of Nuclear Physics, Krakow (Poland); and Institute of Nuclear Techniques, Krakow (Poland).
J. A. Czubek, T. Florkowski, J. Niewodniczanski, and K. Przewlock.
Available from the National Technical Information Service as A/CONF.49/P/334, \$3.00 per copy, \$0.95 microfiche. Report A/CONF.49/P/334, May 1971, 28 p. 11 fig, 85 ref.

Descriptors: *Hydrologic aspects, *Hydrologic cycle, *Reservoir leakage, Seepage, Transportation, Hydrology, Mineralogy, Well logging, Boreholes, Density, Physical properties, Analytical techniques. Identifiers: Mineral resources, Radiometric analysis, Hydrotechnic construction.

A number of radioisotope methods are in routine use in hydrology and hydrotechnic construction. Improvement here is marked by development of new instruments and better planning and interpretation of tracer investigations based also on theoretical considerations. Environmental isotope methods in hydrology are marked by their first applications. Progress also has been made in application of nuclear techniques in the mining industry. Among other uses of radioisotope methods are studying leakage from water reservoirs, mining back fill installation hydrotransportation parameters and determination of the density patterns in pipe cross sections. Still other uses include prospecting and development of mineral resources, bore-hole logging and various radiometric methods of analysis. (Houser-ORNL) W72-03318

APPLICATION OF STABLE AND RADIOACTIVE ISOTOPES TO HYDROLOGY AND SEDIMENTOLOGY,
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires; and Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
E. Roth, L. Merlivat, G. Courtis, R. Cornuet, and J. Guizerix.
Available from the National Technical Information Service as A/CONF.49/P/634, \$3.00 per copy,

\$0.95 microfiche. Report A/CONF.49/P/634, July 1971, 14 p.

Descriptors: *Radioactive tracers, *Stable isotopes, *Radioisotopes, *Tracking techniques, *Movement, Path of pollutants, Hydrology, Sediment transport, Deposition (Sediments), Sedimentation rates, Sediment distribution, Marking techniques, Interfaces, Saline water-Freshwater interfaces, Measurement, Instrumentation, Tritium. Identifiers: Elements and isotopes, Parameter identification, Isotopic balance, Concentration.

The use of radioactive tracers in sedimentary dynamics began in France more than 15 years ago. Since 1965, special attention has been given to developing this promising technique into a routine procedure. This has required that all critical aspects, whether of a fundamental or a technical nature, be thoroughly examined. Conclusions reported here concern stable isotopes in hydrology, applications of the measurement of tritium of a thermonuclear origin, and the application of artificial tracers. (Houser-ORNL) W72-03319

HYDROLOGICAL ISOTOPIC TECHNIQUES FOR THE STUDY OF WATER RESOURCES IN MEXICO,
Universidad Nacional Autonoma de Mexico, Mexico City. Nuclear Lab.; and Comision Nacional de Energia Nuclear, Mexico City.
L. Galvez, M. Navarrete, and B. Andreu.
Available from the National Technical Information Service as A/CONF.49/P/790, \$3.00 in paper copy, \$0.95 in microfiche. Report A/CONF.49/P/790, June 1971, 4 p, 3 ref.

Descriptors: *Mexico, *Geographical sections, *Resource development, *Hydrologic aspect, *Non-structural alternatives, *Radioisotopes, Aquifer characteristics, Transmissivity, Porosity, Permeability, Porous media, Flow, Underflow, Radioactive dating, Recharge. Identifiers: Charge time.

Only a small section of Mexico is adequately supplied with good water resources. Isotopic techniques are used to characterize aquifers and may be used to determine important parameters such as porosity and soil transmission coefficients, direction and velocity of the waters, interconnection of aquifers, and age of the aquifers. The geohydrological research is necessary in arid zones and may supply informative conclusions about the size and charge time of underground resources. (Houser-ORNL) W72-03329

TREATMENT OF MICRONEKTON COLLECTIONS,
Office de la Recherche Scientifique et Technique Outre-Mer, Noumea (New Caledonia). Centre Orstom de Noumea.
A. Michel, and R. Grandperrin.
Mar Biol (Berlin). 8 (3): 238-242. Illus. 1971. English summary. Identifiers: Collections, Grill, Method, Micro, Nekton.

This paper deals with some mechanical treatments of micronektonic samples which enable easier sorting into taxa. At sea, it is only possible to hose the net intensively before being brought on board ship; organisms are then washed into a bucket, the bucket emptied, and the samples preserved in a 10% buffered formaldehyde solution. A laboratory method for sorting gelatinous organisms based on differential specific gravity is described. The sorter consists of a cylinder 1.60 m high, supplied with running water. The remaining fraction is then sorted into 3 size groups. The device consists of a set of grills made from equidistant glass rods, through which organisms are sieved by the reciprocating motion of the grills into a large jar filled with running water. As this method results in

higher sorting efficiency, it is recommended that further research be made in this direction.—Copyright 1971, Biological Abstracts, Inc. W72-03385

A QUANTITATIVE PLANKTON SAMPLER,
Institute of Marine Research, Stockholm (Sweden).
Hans Ackefors.
Oikos. 22 (1): 114-118. Illus. 1971. Identifiers: Distribution, Phyto, Plankton, Quantitative, Sampler, Zoo.

A new construction of a plankton sampler for ecological studies is described. The capacity of the sampler is 23 l. The vertical distribution of zooplankton is fixed levels in the water column can be studied. The sampler can be used in shallow as well as deep waters. As the sampler is provided with a bag net the water is filtered before the sample is taken on board. This makes the sampler light enough to be handled by 1 man in a small boat with the help of a handwinch. The greatest attention has been paid to the mechanical construction of the closing device. The sampler can easily be modified to take water samples for chemical or phytoplankton studies.—Copyright 1971, Biological Abstracts, Inc. W72-03386

7C. Evaluation, Processing and Publication

DEPTH TO BASE OF POTABLE WATER IN THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, Fla.
H. Klein.
Florida Department of Natural Resources, Bureau of Geology Map Series No 42, 1971. 1 Sheet, 1 map, 38 ref.

Descriptors: *Potable water, *Aquifers, *Florida, Maps, Hydrologic data, Saline water-freshwater interface, Artesian wells, Potentiometric level, Kecharge wells, Desalination, Irrigation wells, Water pollution sources, Water users, Planning, Geologic control. Identifiers: *Floridan aquifer, Water atlas.

A folded map of Florida scaled about 110 mi per inch shows by contours and color the approximate depth to the base of potable water in the Floridan aquifer; a short text describes the information on the map and summarizes the hydrologic conditions. The data used in preparing the map were obtained from completed and ongoing hydrologic studies of selected counties, river basins, and other geographic and hydrologic units in Florida. The Floridan aquifer is the principal source of fresh groundwater in central and northern Florida. The fresh-water section in the aquifer is thickest in central Florida, in the Jacksonville area, in an area west of Daytona Beach, and along the northern tier of counties. Major areas of saline-water contamination are southern Florida, much of the east coast, and areas adjacent to the St. Johns and Peace Rivers. Recently the Floridan aquifer has been considered as a source of water for desalination in southern Florida and the Keys, as a storage reservoir for surplus water during rainy seasons, and as a receptacle for injection of certain waste effluents in areas and at depths where the water is highly mineralized. The map portraying the bottom of potable water will be useful to water management agencies in planning for the protection and full utilization of the aquifer. (Lang-USGS) W72-02953

COMPUTER APPLICATIONS IN HYDROLOGY,
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.

Proceedings of Seminar on Computer Applications in Hydrology, Corps of Engineers Hydrologic Engineering Center, February 23-25, 1971, Davis, California. 204 p.

Field 07—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

Descriptors: *Data processing, *Hydrologic data, *Computer programs, *Conferences, *Hydrology, Computer models, Numerical analysis, Simulation analysis, Systems analysis, Input-output analysis, Streamflow, Floods, Flood control, Backwater, Flood protection.
Identifiers: *U S Army Corps of Engineers.

Sixteen papers that were presented at the Seminar on Computer Applications in Hydrology in Davis, California, February 23-25, 1971, by the U.S. Army Corps of Engineers are compiled in this report. Experiences and views are included on such subjects as: Case studies of unique applications of the computer for solving hydrologic engineering problems; Critiques of past use and misuse of computer programs for solving hydrologic engineering problems; Areas where generalized programs are sorely needed; Methods for managing input data or for analyzing, summarizing, and presenting results of computer analyses; Documentation of programs; and The role, and philosophy of development, of generalized computer programs. The views and conclusions expressed are those of the individual seminar participants and are not intended to modify or replace official guidance or directives such as Engineer Regulations, Manuals, Circulars, or Technical Letters issued by the Office of the Chief of Engineers. (Woodard-USGS)
W72-02958

GLACIER MAPS OF CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
W. E. S. Henoch, and A. Stanley.
Journal of Glaciology, Vol 9, No 55, p 149, February 1970. 1 ref.

Descriptors: *Maps, *Glaciers, *Glaciation, Arctic, Mapping, International Hydrological decade.
Identifiers: *Canada.

Glaciological research in Canada received new impetus in 1965 with the organization of the International Hydrological Decade. One of the immediate requirements of research was for a small-scale map showing the distribution of glaciers in Canada, with indication of source of information. This type of map is essential in the selection of areas for further study and in the preparation of a glacier inventory. To meet this requirement, a series of seven maps was produced at scale 1:1,000,000. Three of the maps cover the Canadian Cordillera while the other four cover the Arctic islands and northern Labrador. On each map, the Canadian National Topographic System grid has been superimposed to aid reference to source maps. The date and the scale of all source maps are listed on the reverse of the map. Copies of the series may be obtained at 50 cents each from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa, Ontario, Canada. (Knapp-USGS)
W72-02966

DIRECTIONAL SPECTRA FROM WAVE-GAGE ARRAYS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03085

EQUILIBRIUM RANGE SPECTRA IN SHOAL-ING WATER,
Kyushu Univ., Fukuoka (Japan).
For primary bibliographic entry see Field 08B.
W72-03086

DATA PREPARATION FOR WATER RESOURCE STUDIES,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02H.
W72-03129

FLOOD OF JANUARY 1969 NEAR AZUSA AND GLENDORA, CALIFORNIA,
Geological Survey, Washington, D.C.
F. W. Giessner, and M. Price.
U. S. Geol Survey, Washington, D C 20242 Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-424, 1 sheet, 1971. Text, 6 fig, 1 map, 2 ref.

Descriptors: *Floods, *Flood damage, *Streamflow, *Peak discharge, *California, Flood control, Flood forecasting, Historic flood, Floodways, Runoff, Stream gages, Small watersheds.
Identifiers: *Azusa-Glendoria area (Calif), Hydrologic atlas, Intermediate regional flood.

Flooding and severe debris flows occurred in the Azusa and Glendora, California area in January 1969 as a result of heavy storms. The approximate areas inundated by overflows from small basins east of the San Gabriel River are described in this atlas. The inundation map and graphs show the results of analyses of data on the extent and frequency of the floods. This highly developed and densely populated area lies in the foothills of the San Gabriel Mountains of southern California, about 20 miles east of Los Angeles. The basins are small and the channels are steep. Little Dalton Creek (Washington) is the principal flood-control channel in the report area. This concrete-lined channel carries all floodflow and debris without overflow. The peak discharge of 13,000 cfs at Fish Creek near Duarte, January 25, 1969, was nearly six times that of December 29, 1965, the previous maximum flow of record. The flood of January 1969 has a recurrence interval greater than 70 years, and perhaps greater than 100 years. (Woodard-USGS)
W72-03152

SYMPOSIUM ON THE RESULTS OF RESEARCH ON REPRESENTATIVE AND EXPERIMENTAL BASINS.
For primary bibliographic entry see Field 02A.
W72-03247

SIMULATION OF THE WATER MOVEMENT IN THE HUPSELS BEEK WATERSHED,
Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.
For primary bibliographic entry see Field 02A.
W72-03254

REPRESENTATIVE AND EXPERIMENTAL BASINS AS DISPERSED SYSTEMS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W72-03256

OPTIMIZATION OF A RAINFALL-RUNOFF MODEL FOR AN ARID ZONE CATCHMENT,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
For primary bibliographic entry see Field 02A.
W72-03257

BOUGHTON'S DAILY RAINFALL-RUNOFF MODEL MODIFIED FOR THE BRENIG CATCHMENT,
For primary bibliographic entry see Field 02A.
W72-03258

PRELIMINARY SURFACE WATER RESOURCE PREDICTION IN THE UPPER TAIERI RIVER BASIN,
Ministry of Works, Dunedin (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02A.
W72-03259

THE USE OF PRINCIPAL COMPONENT FACTOR ANALYSIS TO ESTABLISH THE UNIFORMITY OF A HYDROLOGICAL REGION IN NORTHLAND, NEW ZEALAND,
Ministry of Works, Water and Soil Div. Wellington (New Zealand).
For primary bibliographic entry see Field 02A.
W72-03260

NEGATIVELY SKEWED DISTRIBUTION OF RUNOFF,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02A.
W72-03262

ESTIMATION OF THE STATISTICAL CHARACTERISTICS OF SOME EVENTS ON THE BOUNDS OF THE INFORMATION GAINED FROM SOME OBSERVATIONS OF OTHER CORRELATED PHENOMENA,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 02A.
W72-03263

A MARKOV CHAIN MODEL FOR RAINFALL GENERATION,
Auckland Univ. (New Zealand). School of Engineering.
For primary bibliographic entry see Field 02B.
W72-03264

DIFFICULT PROBLEMS ABOUT SMALL EXPERIMENTAL BASINS AND NECESSITY OF COLLECTING INFORMATION ON LARGE BASINS,
National Research Center for Disaster Prevention, Tokyo (Japan).
For primary bibliographic entry see Field 02A.
W72-03268

RESEARCH RESULTS FROM MARMOT CREEK EXPERIMENTAL WATERSHED, ALBERTA, CANADA,
Canadian Forestry Service, Calgary (Alberta).
For primary bibliographic entry see Field 02A.
W72-03269

THE TRANSFER VALUE OF INFORMATION COLLECTED ON REPRESENTATIVE BASINS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02A.
W72-03275

DIGITAL EVENT RECORDERS FOR REPRESENTATIVE AND EXPERIMENTAL BASINS,
Ministry of Works, Wellington (New Zealand). A. Chandler, and J. E. Patterson.
In: Symposium of the Results of Research on Representative and Experimental Basins, Wellington, New Zealand, December 1-8, 1970; International Association of Scientific Hydrology Publication No 96, p 700-707, 1970. 7 fig, 4 ref.

Descriptors: *Data collections, *Hydrologic data, *Stream gages, *Rain gages, Automation, Monitoring, Data processing, Demonstration watersheds.
Identifiers: *Hydrologic data recorders, *Representative watersheds, *Experimental watersheds.

There has been a rapid increase in the number of representative and experimental basins instrumented in New Zealand. The most satisfactory means for obtaining accurate and detailed data for precipitation and water levels to meet hydrological research requirements on representative basins, is through the use of analog-to-digital recorders. The advantages that these have over chart recorders are accuracy and ease of processing, but the fixed-

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time system employed has disadvantages. Modifications were developed by the staff of the New Zealand Ministry of Works, to modify analog-to-digital recorders in such a way as to overcome the problem of excess data. Existing equipment was modified, rather than new equipment developed, because of the viable systems already in use for operation, maintenance, and translation. Events, such as a pulse from a tipping bucket rain gage, are recorded on standard analog-to-digital water-level recorders by modifying the punch-out circuit and adding a clock to drive the input shaft. Elapsed time is then recorded each time an event occurs. Since the punch-out cycle is event actuated no redundant data are punched. Further modifications, including event-control of the punch-out rate, allow water-level recordings to be made with considerable reductions in redundant data. (See also W72-03247) (Knapp-USGS)
W72-03280

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 05A.
W72-03282

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG, Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 05A.
W72-03286

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION, Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 05A.
W72-03287

08. ENGINEERING WORKS

8A. Structures

GEOLOGY AND DAMS.

All-Union State Inst. 'Gidroenergoproekt', Moscow (USSR).

Available from the National Technical Information Service as TT-70-59128, \$6.00 in paper copy, \$0.95 in microfiche. 1971, 584 p. Trans. of Geologiya i Plotiny (USSR) Vol. 5. 1967, 208 p. For NSF and Bur. Reclamation.

Descriptors: *Engineering geology, *Dams, Construction, Earth dams, Rockfill dams, Foundation investigations, Mapping, Rock mechanics, Erosion, Floods, Weirs, Rivers, Hydroelectric power generation, Soil properties, Translations, Handbooks, USSR.

Contents: Kama Dam on river Kama; Kairakkum Dam on river Syr-Dar'ya Head*Dam on river Vakhsh; Uch-Kurgan Dam on river Naryn; Lower-Bozsu Dam no. 4 on irrigational channel Lower-Bozsu; First Khrami Dam on the river Kharami; Dubossar Dam on river Dniester; Kiev Dam on river Dnieper; Belorech Dam on river Belaya; Gumati Dam on river Rioni; Krasnoyarsk Dam on river Enisei; Engineering-Geological conditions for the construction of dams on glacial deposits in Kareliya and at Kola Peninsula.
W72-02977

COASTAL ENGINEERING - 1970 PROCEEDINGS.
For primary bibliographic entry see Field 08B.
W72-03078

IMPROVEMENT OF NAVIGATION CONDITIONS, CONNEAUT HARBOR, OHIO; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-03138

WAVE AND SURGE CONDITIONS AFTER PROPOSED EXPANSION OF MONTEREY HARBOR, MONTEREY, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-03139

KASKASKIA RIVER NAVIGATION PROJECT, ILLINOIS; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-03140

FILLING AND EMPTYING SYSTEM DARDANELLE LOCK, ARKANSAS RIVER; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-03141

EXPANSION OF SANTA BARBARA HARBOR, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-03142

OUTLET TRANSITIONS WITH TRIANGULAR-SHAPED BAFFLES, Utah State Univ., Logan. Coll. of Engineering. Lloyd H. Austin, Gaylord V. Skogerboe, and Ray S. Bennett.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 97, No. IR 3, p 443-448, Sept. 1971. 13 fig, 11 ref, 2 append. OWRB B-018 UTAH (3).

Descriptors: *Hydraulic structures, *Open channel flow, Drainage, Energy losses, Head losses, Hydraulic design, Nonuniform flow, Subcritical flow, Baffles.

Laboratory hydraulic studies have been used to determine the proper location for triangular-shaped baffles in open channel expansions having vertical walls. The outlet transition structures that were studied ranged from the abrupt expansion to divergences of 1:1, 2:3, 1:3, and 1:6. The design procedure for outlet transitions with triangular-shaped baffles incorporates the analysis of energy loss in outlet transitions.
W72-03191

FAILURE OF CONVENTIONAL DAMS BY OVERTOPPING, Technische Hochschule, Vienna (Austria). A. Grzywnski.
Paper 7313, Institution of Civil Engineers Proceedings, Vol 48, p 35-50, Jan 1971. 16 p, 16 fig, 7 ref.

Descriptors: Dams, *Dam failure, Model studies, Model tests, Disasters, *Rockfill dams, Test

results, Dam design, Landslides, Washouts, Hydraulic structures, Waves (Water).
Identifiers: Austria, Dam breaches, Dam crests, *Overtopping.

The number of hydraulic structures being built and the boldness of their design is continually increasing. As the height of large dams becomes greater, more potential energy is stored, thus augmenting the danger to the exposed areas downstream of the dams. Some of the unusual hydraulic model tests performed at the laboratories of the Institute of Technology in Vienna are described. A rockfill dam, over 100 m high, was chosen as a prototype. The dam and the valley upstream and downstream were reproduced to a scale of 1:500. Several smaller models and sectional models were also built. Research was conducted on the failure of the model dam, caused by various types of overflow, and by wave attacks similar to those resulting from landslides. The washout process was studied; flood waves following the rupture were investigated. Consideration was given to the development of design methods based on the results of the model tests. (USBR)
W72-03212

THE LAKE TAP AT THE ASKARA HYDROELECTRIC PROJECT, Groner (Chr. F.) A/S, Oslo (Norway). C. F. Groner, and E. Solbraekke.
Water Power, Vol 23, No 7, pp 254-259, July 1971. 6 p, 6 fig.

Descriptors: *Tunnels, *Model studies, *Gates, Lakes, Reservoirs, Sounding, Seismic studies, Blasting, Intake structures, Tunnel design, Tunnel construction, Foreign projects, Foreign design practices, Foreign construction.
Identifiers: *Askara Project, Norway, *Piercing (Lakes), Layout, Location surveys, Rock traps, Underwater television.

Of the 300 lake taps constructed in Norway in the past 60 yr, Askara tap is the deepest ever attempted there. The Askara project is located on a fjord on the west coast about 100 mi north of Bergen. The depth of the lake is about 90 m and the maximum water level is at El 693 m. The lake was tapped at the end of the headrace tunnel with the invert at El 600 m. The tunnel alignment from the bottom of the gate shaft extends 300 m beneath the lake bottom toward the tap location. Penetration was established about 85 m below the lake water surface. The inflow of water was small even when only about 5 m of sandstone rock remained between the soffit of the tunnel and the lake bottom. The realization of water-free working conditions was attributed to the thorough investigation of the tunnel alignment. The scope of the investigative work was greater than would be required for a tap at lesser depth, because corrective work at this depth might not be possible should difficulty be encountered. The project features, investigations, layout, tap geometry, blasting, model studies, and excavating methods above the tunnel invert to catch the plug fragments are described. (USBR)
W72-03213

8B. Hydraulics

SEEPAGE BENEATH HOOVER DIKE, SOUTHERN SHORE OF LAKE OKEECHOBEE, FLORIDA, Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 04A.
W72-02954

TIDAL HYDRODYNAMIC SIMULATION IN SHALLOW ESTUARIES, Texas Univ., Austin. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02L.
W72-03053

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A SLOWLY-VARYING CONSERVATIVE TRANSPORT MODEL FOR SHALLOW ESTUARIES,
Texas Univ., Austin. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02L.
W72-03054

A SHORT-TERM CONSERVATIVE TRANSPORT MODEL FOR SHALLOW ESTUARIES,
Texas Univ., Austin. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02L.
W72-03055

COASTAL ENGINEERING - 1970 PROCEEDINGS.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, American Society of Civil Engineers, New York, N Y, 1970, 3 vol, 2, 286 p.

Descriptors: *Coastal engineering, *Water management (Applied), *Engineering structures, Design criteria, Waves (Water), Beach erosion, Shore protection, Energy losses, Sediment transport, Deposition (Sediment), Littoral drift, Erosion control, Scour, Estuaries, Bays, Harbors, Tidal waters, Analytical techniques, Hydraulics. Identifiers: *Coastal Research Council (ASCE), Wave theory, Storm characteristics, Erosion process.

The proceedings of the Twelfth Conference on Coastal Engineering are presented in three volumes containing a total of 138 papers. The purpose of the conference is to improve the art and science related to design and planning of coastal works worldwide. This conference was sponsored jointly by the Coastal Engineering Research Council of the American Society of Civil Engineers and the American Shore and Beach Preservation Association. The International Association for Hydraulic Research cooperated with the ASCE groups in carrying out the conference. A short history is given of previous conferences beginning with the first held at Long Beach, California in Oct. 1950, and includes the names of the research councils which sponsored them. Papers presented in the proceedings lean heavily on the sciences of oceanography, meteorology, fluid mechanics, electronics, structural mechanics, and hydraulics generally as applied to shoreline problems. Emphasis is on the dynamic behavior of water as it influences structural design. (See also W72-03079 thru W72-03114) (Lang-USGS)
W72-03078

OCEAN WAVE RESEARCH IN SOUTHERN AFRICA,
Council for Scientific and Industrial Research, Stellenbosch (South Africa). National Mechanical Engineering Research Inst.
J. A. Zwamborn, C. van Schaik, and A. Harper.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 1; American Society of Civil Engineers, New York, N Y, p 1-13, 1970. 13 fig, 1 tab, 11 ref, append.

Descriptors: *Ocean waves, *Waves (Water), *Data collections, Hydrologic data, Instrumentation, Shore protection, Hydraulics, Surf, Oceanography, Coastal engineering.
Identifiers: *South Africa.

Wave recording on a national basis in South Africa commenced in 1967, when a project was initiated, aimed at obtaining reliable data on sea conditions around the shorelines of the Republic and South West Africa and to improve on wave prediction techniques. Wave recording stations are being operated or are being installed about 300 km apart, along the entire coastline. Records are supplemented by deep sea data obtained from five research vessels operating in coastal waters. Instruments using optical, accelerometer, acoustic and pressure measuring systems are being used to

obtain wave recordings. The following instruments are in use: 11 Wave clinometers, 5 NIO shipborne wave recorders, 2 INES wave recorders, 1 Wave rider system, 1 Boersma wave height meter, and 1 Ospos wave recorder. (See also W72-03078) (Knapp-USGS)
W72-03079

SWELL AND STORM CHARACTERISTICS FROM COASTAL WAVE RECORDS,
Naval Postgraduate School, Monterey, Calif.
W. C. Thompson.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 33-52, 1970. 7 fig, 1 tab, 7 ref.

Descriptors: *Ocean waves, *Frequency analysis, *Winds, Data collections, California, Time series analysis, Energy, Data processing, Storms, Pacific Ocean, Beach erosion, Coastal engineering.
Identifiers: Monterey (Cal).

Records from a wave sensor at Monterey, California yield a linear frequency shift associated with each arriving swell train, from which the origin time and travel distance of the swell can be computed. Surface weather maps can be used to find the source and the deep-water arrival direction of the swell. The wave records are analyzed for the frequency of the individual waves composing wave groups. Five of the swell sets originated in North Pacific storms advancing toward Monterey. The seas in the fetch were fully arisen at the time of computed swell origin, and the surface to geostrophic wind ratio was 0.83. The dominant swell emerged from the fetch at a time when its group velocity equalled the velocity of the fetch toward Monterey. (See also W72-03078) (Knapp-USGS)
W72-03080

MAXIMUM WAVE HEIGHT PROBABILITIES FOR A RANDOM NUMBER OF RANDOM INTENSITY STORMS,
Wyoming Univ., Laramie. Dept. of Geology; and Wyoming Univ., Laramie. Dept. of Statistics.
L. E. Borgman.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington DC, Volume 1; American Society of Civil Engineers, New York, NY, p 53-64, 1970. 1 tab, 8 ref.
Coastal Eng Res Center Contract DACW-72-69-c-0001.

Descriptors: *Probability, *Waves (Water), *Energy, Ocean waves, Statistics, Statistical methods, Statistical models, Oceanography, Coastal engineering, Distribution patterns, Time series analysis.
Identifiers: *Wave height probability.

A statistical model for the probability distribution function for wave heights in storms with time-varying intensities expresses the probabilities for a random number of random length storms each with random intensities. The application of the formula requires a digital computer and detailed analysis of the historical data for the particular location of interest. (See also W72-03078) (Knapp-USGS)
W72-03081

SPECTRAL COMPUTATIONS ON PRESSURE WAVE GAUGE RECORDS,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
M. M. de Carvalho, F. S. Ramos, and C. de C. Moraes.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 65-83, 1970. 18 fig, 9 tab, 10 ref.

Descriptors: *Waves (Water), *Ocean waves, *Time series analysis, Fourier analysis, Hydrologic data, Data collections, Data processing, Oceanography, Coastal engineering.
Identifiers: Portugal.

To establish sea wave data-processing procedures to be applied to records obtained at the Portuguese coast, a detailed study was made of parameters used in one-dimensional spectral analysis of a pressure wave gauge record. Statistics computed by the selected spectral procedure were compared with results of a Tucker-Draper analysis of the same record. Hindcasts of sea conditions for the date and place of the record were made by different methods and compared with the spectral analysis. (See also W72-03078) (Knapp-USGS)
W72-03082

DIRECTIONAL SPECTRA FROM WAVE-GAGE ARRAYS,
California Univ., Berkeley. Dept. of Civil Engineering.
N. N. Panicker, and L. E. Borgman.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 117-136, 1970. 9 fig, 46 ref.
Coastal Eng Res Center Contract DACW 72-68-C-0016.

Descriptors: *Ocean waves, *Data collections, *Data processing, *Frequency analysis, *Fourier analysis, Time series analysis, Networks, Energy, Analytical techniques.
Identifiers: Wave gages.

If the ocean is considered to be composed of many waves traveling at different directions with different frequencies, the allocation of wave energy to the different component frequencies and directions is the directional spectrum. An analytical procedure is given to obtain the directional spectrum from records of an array of wave gages. The locked phase method can be used to obtain the distribution of phase as well as energy of the waves with respect to frequency and direction and is a deterministic approach. The random phase analysis is more suitable for wind waves in the ocean and yields the distribution of energy alone. The procedures are programmed for computers, and were checked using both simulated data and laboratory data. Wave records of the Pacific Ocean obtained off Point Mugu, California, on a 5-gage array were analyzed using the method developed and examples of the directional spectra obtained are presented. (See also W72-03078) (Knapp-USGS)
W72-03085

EQUILIBRIUM RANGE SPECTRA IN SHOALING WATER,
Kyushu Univ., Fukuoka (Japan).
T. Ijima, T. Matsuo, and K. Koga.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 137-149, 1970. 9 fig, 7 ref.

Descriptors: *Ocean waves, *Waves (Water), *Surf, Dimensional analysis, Fourier analysis, Frequency analysis, Instrumentation, Depth, Coastal engineering.

In shoaling water on sloping beach, waves break by hydraulic instability due to the finiteness of water depth, so that frequency spectra of waves in surf zone must have a limiting form similar to an equilibrium spectra. An equilibrium form of spectra for surf waves was derived from the limiting wave condition at constant water depth and from breaking wave experiments on sloped bottoms. The results are compared with surf wave spectra obtained from field observations by means of stereo-type meters. By means of this spectra and by deep water wave spectra for various wind con-

ditions, significant wave heights and optimum periods of limiting waves in surf zone are calculated. (See also W72-03078) (Knapp-USGS) W72-03086

WAVE INVESTIGATIONS IN SHALLOW WATER.

Forschungsgruppe Neuwerk, Cuxhaven (West Germany). W. Siefert.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 151-178, 1970. 9 fig, 8 ref.

Descriptors: *Waves (Water), *Estuaries, Frequency analysis, Winds, Time series analysis, Coastal engineering, Fourier analysis. Identifiers: Elbe estuary (Germany).

In the deeper water of the Elbe estuary, the value of the quotient relating the significant and the mean wave heights is larger than on the bordering tidal flat. The value of this function is dependent on the height of the waves; on the tidal flat this dependency is considerably more sensitive than in deeper water. With increasing wave height the value of significant wave height divided by mean height becomes smaller. The propagation direction of waves moving onto the tidal flat depends upon the position of intertidal channels. Such channels sharply reduce the possible propagation directions. The waves nearly always move up-channel regardless of the wind direction. It is possible to derive wave period and wave height distributions representing the conditions in very shallow water. (See also W72-03078) (Knapp-USGS) W72-03087

EXPERIMENTAL STUDIES ON THE GENERATION OF WAVES IN SHALLOW WATER.

Taiwan Provincial Cheng Kung Univ., Tainan. C. T. Kuo, and F. L. W. Tang.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 179-201, 1970. 20 fig, 2 ref.

Descriptors: *Waves (Water), *Ocean waves, *Winds, *Shallow water, Coastal plains, Coastal engineering. Identifiers: China, Taiwan.

Waves approaching the Yellow Sea, East China Sea, and Taiwan Strait coasts are generated in shallow water. In order to investigate the generating process of shallow water wind waves and obtain more detailed information for correcting calculation criteria, a series of experiments were performed in a wind tunnel, 75 meters in length. The generation of shallow water waves resembles that of deep water waves, however, the generation time is much shorter. Wave period seems not to be significantly influenced by water depth. The wave height increases with fetch length. (See also W72-03078) (Knapp-USGS) W72-03088

WAVE FORECASTING FOR THE WEST COAST OF INDIA.

Karnataka Regional Engineering Coll., Surathkal (India). Dept. of Civil Engineering. J. Dattatri, and P. S. Renukaradhyia.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 203-215, 1970. 3 fig, 1 tab, 7 ref.

Descriptors: *Waves (Water), *Instrumentation, *Forecasting, *Calibrations, Data collections, Data processing, Coastal engineering, Hydrologic data, Synoptic analysis. Identifiers: *Wave forecasting.

Synoptic charts were analyzed to obtain the necessary wind characteristics for wave forecasting on the coasts of India. The computed wind characteristics were used to yield significant wave heights. These were compared with the wave characteristics as recorded by sub-surface pressure recorder. The two commonly used methods of wave forecasting are the Sverdrup-Munk-Breschneider method (SMB method) and the Pierson-Neumann-James method (PNJ method). These methods are based almost entirely on field data and as such can be used with confidence in areas from where the field data is taken. The predicted wave heights are consistently smaller than the recorded heights for smaller wind velocities. For wind velocities greater than 15 knots there is a strong tendency for the predicted wave heights to be more than the recorded heights. Between the two methods, the SMB method appears to be closer to the recorded wave heights than the PNJ method. The generating areas for the waves that reach the Mangalore area on the West Coast of India, lie between 10 deg and 18 deg latitude North and 64 deg, and 74 deg E longitudes. The fetch lengths in the monsoon period lie between 200 to 600 NM. The maximum calculated wind velocity is about 40 knots, while generally winds peak at around 25 knots. (See also W72-03078) (Knapp-USGS) W72-03089

COMPILATION OF OCEAN AND LAKE WAVE STATISTICS.

Coastal Engineering Group, Los Angeles, Calif. J. S. Hale.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 217-222, 1970. 8 ref.

Descriptors: *Ocean waves, *Surf, *Data collections, *Data processing, *Computer programs, Waves (Water), California, Coastal engineering, Hydrologic data, Statistics. Identifiers: Wave statistics.

Wave statistics are collected by Los Angeles County life guards observing wave heights, directions and periods. Wave statistics are gathered continuously over many years. After recording the name of the beach, the position on the beach and the date, the lifeguards record the average breaking wave heights, directions and periods. These tabulations are made twice every day. Once the data are edited and sorted for the I.B.M. 1620, it takes only 7 minutes to tabulate an entire years observations for one point on the County Coast line. Accuracy is well within the limit needed. The data processing program for the I. B. M. 1620 and 360 systems is available in the Office of the Los Angeles County Engineer, where it is filed as Library Program No. TGO16. (See also W72-03078) (Knapp-USGS) W72-03090

MACRO-TURBULENCE FROM WIND WAVES.

Tri-State College, Angola, Ind. Dept. of Civil Engineering. C-Y Lee, and F. D. Masch.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 223-242, 1970. 7 fig, 8 ref. FQWA Grant 5 RO1 WP 00705.

Descriptors: *Turbulence, *Waves (Water), *Winds, *Vortices, Hydraulic models, Laboratory tests, Flumes, Correlation analysis, Fourier analysis, Energy, Stochastic processes. Identifiers: Macro-turbulence.

A wind wave flume was used to investigate the macro-scale turbulence associated with wind waves and white cap conditions. Velocity fluctuations in water were measured with a hot film anemometer and correlations between wind waves and turbulence characteristics were established. Auto-covariance functions and power spectral

density functions were then obtained for all sample records. The depth of the penetration of the macro-scale turbulence increased rapidly with wind speed, but the rate of penetration diminished at the higher wind speeds. The rate of macro-turbulence penetration varies inversely with wave height and wave steepness. Most turbulence fluctuations with frequencies equal to or higher than the frequency of the ambient surface waves were confined to the zone of macro-turbulence penetration, although some disturbances occasionally penetrated to greater depths. Energy dissipation increased with wave height and almost all wave energy dissipation was concentrated near the water surface. (See also W72-03078) (Knapp-USGS) W72-03091

THE SHEAR STRESS OF SEA BREEZE ON A SWASH ZONE.

Louisiana State Univ., Baton Rouge, Coastal Studies Inst. S.-A. Hsu.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 243-255, 1970. 3 fig, 1 tab, 17 ref. ONR Contract N00014-69-A-0211-0003, NR 388 002.

Descriptors: *Waves (Water), *Surf, *Shear stress, *Sea breeze, Ocean waves, Beaches, Shores, Coastal engineering, Beach erosion. Identifiers: Swash zone.

Measurements of shear stress under the effect of a sea breeze were made by simultaneous wind and temperature profiles over a shore near Fort Walton Beach, Florida. The sea breeze in the surface boundary layer is in the atmospheric free-convection regime. The measured shear stress coefficient is in conformity with that obtained by the sea surface tilt method. The shear data are more reliable than are coefficients obtained under neutral stability for this localized coastal wind system. (See also W72-03078) (Knapp-USGS) W72-03092

ENERGY LOSSES UNDER WAVE ACTION.

Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.

R. D. Treloar, and A. Brebner.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 257-267, 1970. 3 tab, 7 ref.

Descriptors: *Waves (Water), *Energy, *Energy losses, *Hydraulic models, Dimensional analysis, Boundary layers, Turbulence, Flumes. Identifiers: Wave-energy losses.

Wave-height attenuation measurements were made in two flumes of different widths, and the results used to separate bottom energy losses from sidewall energy losses. These energy losses, in the form of rates of energy dissipation, were then compared with their theoretical values as calculated by solving the linearized Prandtl boundary layer equations and evaluating the Rayleigh dissipation function. Using these results, and adjusted formula for the wave-height attenuation modulus was determined. (See also W72-03078) (Knapp-USGS) W72-03093

BOTTOM BOUNDARY SHEAR STRESSES ON A MODEL BEACH.

Louisiana State Univ., Baton Rouge. Dept. of Geology, and Army Coastal Engineering Research Center, Washington, D.C. P. G. Teleki, and M. W. Anderson.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil En-

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ineers, New York, NY, p 269-288, 1970. 11 fig, 1 tab, 24 ref.

Descriptors: *Beaches, *Waves (Water), *Shear stress, *Turbulent boundary layers, Turbulent flow, Erosion, Beach erosion, Sediment transport, Instrumentation, Hydraulic models, Model studies, Surf.
Identifiers: Preston tubes.

The maximum amplitude of shear stress in the bottom boundary layer of water waves was evaluated with a Preston probe. Near-bottom velocity profiles were obtained in laminar and developing turbulent flow conditions. Agreement between experimental bottom velocities and those calculated from Airy theory deteriorate with decreasing depth on the beach, resulting in lower shear stress values than predicted by linear theory. The measured boundary layer thickness on the slope exceeds the predicted for horizontal bottom, increasing shoreward to a critical depth outside the breaker zone; from there it decreases shoreward. The influence of roughness on the shear stress distribution is considerable in the offshore region, but becomes negligible near the breaker zone. (See also W72-03078) (Knapp-USGS)
W72-03094

VARIATION OF LONGSHORE CURRENT ACROSS THE SURF ZONE,

Naval Postgraduate School, Monterey, Calif.
E. B. Thornton.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 291-308, 1970. 3 fig, 9 ref.

Descriptors: *Surf, *Littoral drift, *Currents (Water), *Waves (Water), Shear stress, Sediment transport, Sedimentation, Mathematical models, Roughness (Hydraulic), Beach erosion, Coastal engineering.
Identifiers: Longshore currents.

The wave-induced longshore current variation across the surf zone is described for a simplified model, using as basic assumptions that the conditions are steady, the bottom contours are straight and parallel but allow for an arbitrary bottom profile, the waves are adequately described by linear theory, and that spilling breakers exist across the surf zone. Conservation equations of mass, momentum, and energy, separated into the steady and unsteady components, are used to describe second-order-wave-induced phenomena of shoaling waves approaching at an angle to the beach. An expression for the longshore current is based on the alongshore component of excess momentum flux due to the presence of unsteady wave motion. Wave set-down and set-up are included in the formulation. Comparison with experimental results from the laboratory and field show that if the assumed conditions are approximately fulfilled, the predicted results compare quite favorably. (See also W72-03078) (Knapp-USGS)
W72-03095

HORIZONTAL WATER PARTICLE VELOCITY OF FINITE AMPLITUDE WAVES,

Kyoto Univ. (Japan). Dept. of Civil Engineering.
Y. Iwagaki, and T. Sakai.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 309-325, 1970. 8 fig, 2 tab, 11 ref.

Descriptors: *Waves (Water), *Energy, *Velocity, *Hydraulic models, Instrumentation, Coastal engineering, Surf, Coastal structures, Beaches.
Identifiers: Finite amplitude waves (Water).

Two methods were developed to measure vertical distribution and time variation of horizontal water particle velocity induced by surface waves in a

wave tank. These two methods consists of tracing hydrogen bubbles and using hot film anemometers. The experimental results of the two methods are presented with the theoretical curves derived from small amplitude wave theory, Stokes wave theory, and the hyperbolic wave theory. In computing the wave force acting on submerged structures, Stokes wave theory may give too small values of the horizontal water particle velocity at the water surface. (See also W72-03078) (Knapp-USGS)
W72-03096

A SYSTEM FOR MEASURING ORBITAL VELOCITIES IN WAVES,

Pan American Petroleum Corp., Tulsa, Okla.
M. M. Kolpak, and P. S. Eagleson.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 327-343, 1970. 11 fig.

Descriptors: *Waves (Water), Instrumentation, Velocity, Flow, Hydraulic models, Calibrations, Surf, Coastal engineering.
Identifiers: Orbital velocity (Waves).

A single-ended, cylindrical hot-film sensor and a direction-vane transducer can be used for measuring flow fields in waves. The instruments were tested in a laboratory wave system using stationary and traversing measuring techniques. The velocity measurements were compared to those obtained by a photographic technique, to determine instrument error. The maximum hot-film error in flow speed measurements is between plus or minus .5 and plus or minus 1.0 inches/sec. for the range 1 to 11 inches/sec. The direction vane response is subject to errors larger than 5 deg. (See also W72-03078) (Knapp-USGS)
W72-03097

SHOALING OF FINITE-AMPLITUDE WAVES ON PLANE BEACHES,

Stanford Univ., Calif. Dept. of Civil Engineering.
R. K. C. Chan, and R. L. Street.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 345-361, 1970. 12 fig, 17 ref.

Descriptors: *Beaches, *Surf, *Waves (Water), *Simulation analysis, *Mathematical models, Numerical analysis, Pressure, Velocity, Flow, Coastal engineering, Laminar flow.
Identifiers: Finite amplitude waves (Water).

Shoaling of large water waves with particular application to storm-generated waves and tsunamis was studied using simulation on a digital computer of finite-amplitude waves advancing on a beach of constant slope. The flow field is represented by a rectangular mesh of cells and by a line of hypothetical particles which defines the free surface. Based on the Navier-Stokes equations, finite-difference equations were derived so that the entire flow configuration could be advanced through a finite increment of time. The pressure and velocity components are used directly as the dependent variables. This scheme is computationally stable if the cell size and the time increment are properly selected. (See also W72-03078) (Knapp-USGS)
W72-03098

PERIODIC WAVES SHOALING IN WATERS OVER STEEPLY SLOPING BOTTOMS,

Indian Inst. of Tech., Madras. Dept. of Civil Engineering.
H. R. Ayyar.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 363-376, 1970. 7 fig, 7 ref.

Descriptors: *Surf, *Beaches, *Model studies, Hydraulic models, Mathematical models, Slopes, Computer programs, Coastal engineering, Waves (Water), Ocean waves.

The bottom bed slope plays a vital role in the shoaling and breaking of periodic waves. The effect of steep slopes (range steeper than 1:10) on the breaking point and the breaker trajectory and the point of impact was investigated analytically and by model studies. From dimensional analysis of the variables involved, it was found that the factors influencing the breaker characteristics are the incident wave steepness and the bottom slope function. For slopes flatter than 1:5, all the breaking action of the wave takes place shoreward of the breaking point. For slopes steeper than 1:5, the values of breaking depth increase sharply due to the seaward retardation of the breaker. (See also W72-03078) (Knapp-USGS)
W72-03099

BREAKING WAVE SETUP AND DECAY ON GENTLE SLOPES,

Tetra Tech., Inc., Pasadena, Calif.
L. S. Hwang, and D. Divoky.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 377-389, 1970. 7 fig, 14 ref.

Descriptors: *Surf, *Waves (Water), Wave pile-up, Model studies, Mathematical models, Beaches, Slopes, Hydraulic jump, Bores, Coastal engineering.
Identifiers: Wave transformation, Wave set-up.

Waves of large amplitude on a gentle slope may form spilling breakers which propagate shoreward and are slowly transformed. In addition, wave setup is a modification of the mean water level. An analytical description based upon consideration of momentum flux was developed to predict wave setup and the decay history of breaking waves. The effect of wave setup on breaking wave transformation is particularly important near the shoreline, where setup dominates the vanishing mean depth. (See also W72-03078) (Knapp-USGS)
W72-03100

AIR ENTRAINMENT AND ENERGY DISSIPATION IN BREAKERS,

Technische Hochschule, Hanover (West Germany). Franzius-Institut fuer Grund- und Wasserbau.
A. Fuhrboter.
Proceedings of the Twelfth Coastal Engineering Conference September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 391-398, 1970. 3 fig, 4 ref.

Descriptors: *Surf, *Air entrainment, *Energy dissipation, *Beaches, Coastal engineering, Sediment transport, Beach erosion, Aeration, Mixing, Turbulence, Waves (Water).

Even in shallow water, only a part of wave energy is lost by turbulent viscosity and bottom friction; most of wave energy transfer takes place in the narrow zone of surf. From the beginning of breaking the effect of aeration cannot be neglected. The sudden reduction of wave height and wave energy inside the surf zone can be explained by the entrainment of air bubbles into the water. Except compression and surface tension effects, most of wave energy is stored at first by the static energy of the air bubbles which are driven into the water. In a plunging breaker the wave energy is dissipated in less than one wave length; for a spilling breaker, this distance is of the order of several wave lengths. After formation of the air-water-mixture, the energy of the air bubbles is transformed by the microturbulence of the eddies in the turbulent wakes behind the uprising bubbles. Turbulence spectrum is connected with the air content of the water; this is also of importance in sediment transport. (See also W72-03078) (Knapp-USGS)

W72-03101

PROBABILITIES OF BREAKING WAVE CHARACTERISTICS,

Tetra Tech., Inc., Pasadena, Calif.

J. I. Collins.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 399-414, 1970. 14 fig, 17 ref. ONR Contract N00014-69-C-0107.

Descriptors: *Surf, *Beaches, *Energy dissipation, *Probability, Mathematical models, Hydrodynamics, Statistical models, Ocean waves, Waves (Water).

Utilizing the hydrodynamic relationship for shoaling and refraction of waves approaching a shoreline over parallel bottom contours, a procedure was developed to transform an arbitrary probability density of wave characteristics in deep water into the corresponding breaking characteristics in shallow water. A number of probability distributions for breaking wave characteristics were derived in terms of assumed deep water probability densities of wave heights, wave lengths and angles of approach. Some probability densities for wave heights at specific locations in the surf zone were computed for a Rayleigh distribution in deep water. The probability computations were used to derive the expectation of energy flux and its distribution. (See also W72-03078) (Knapp-USGS) W72-03102

CHARACTERISTICS OF WAVES BROKEN BY A LONGSHORE BAR,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

E. C. McNair, Jr., and R. M. Sorensen.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 415-434, 1970. 13 fig, 1 tab, 10 ref.

Descriptors: *Waves, *Sand bars, *Surf, *Energy dissipation, Frequency analysis, Beaches, Coastal engineering, Hydraulic models, Model studies, Energy.

When monochromatic waves break over an offshore bar, most of the energy in the reformed waves is at the same period as in the incident wave but a large portion of the energy shifts to higher frequencies. The ratio of equivalent wave heights (square root of wave energy per unit surface area) before and after the bar depends primarily on the ratio of the incident wave height to water depth over the bar crest. Waves breaking over a two-dimensional model submerged offshore bar in a wave tank were studied for three different depths of water over the bar. For each wave, water surface time-histories were measured at points before and after the bar and spectral analyses of these measurements were performed. (See also W72-03078) (Knapp-USGS) W72-03103

VELOCITY FIELDS IN THE WAVE BREAKER ZONE,

Lagos Univ. (Nigeria). Faculty of Engineering.

M. D. Adeyemo.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 435-460, 1970. 13 fig, 1 plate, 11 ref.

Descriptors: *Surf, *Beaches, *Waves (Water), Velocity, Model studies, Beach erosion, Coastal engineering, Turbulence, Turbulent flow, Slopes, Sediment transport, Currents (Water).

Water-particle velocity fields in the neighborhood of breakers and the correlation between the wave

asymmetry and the velocity asymmetry were studied in wave tanks. Horizontal velocities increase in shoaling water, and for both slopes of 1:9 and 1:18 the greatest horizontal velocities occurred at the wave breaker position. Maximum horizontal shoreward velocity did not occur directly under the wave crest but at a time after the passage of the crest. Values of the horizontal velocity asymmetry were higher on the flatter slope. Shoreward motion takes a longer time on the flatter slope. Stokes theory is not directly applicable to the study of the velocity patterns in the near breaker zone. (See also W72-03078) (Knapp-USGS) W72-03104

THE DEVELOPMENT OF UNDULAR BORES WITH FRICTION,

Manitoba Univ., Winnipeg. Dept. of Mechanical Engineering.

O. Hawaleshka, and S. B. Savage.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 461-472, 1970. 8 fig, 10 ref.

Descriptors: *Bores, *Waves (Water), *Open channel flow, *Hydraulic jump, Model studies, Hydraulic models, Fluid friction, Velocity, Surf, Numerical analysis, Mathematical models.

A theoretical and experimental study was made of the initial development of undular bores in two-dimensional, rectangular channels with and without boundary friction. Equations similar to those of Boussinesq, but including higher order and wall friction terms are presented and solved numerically by an implicit finite difference method. A Pohlhausen-type boundary layer momentum integral method gives the wall shear stress distribution under a developing long wave. A quasi-iterative solution proceeds from the friction coefficient calculation for an initially assumed wave profile to the inclusion of this coefficient in the calculation of a new wave profile at an advanced time. For the initial development of undular bores measurements are in reasonable agreement with theoretical predictions. (See also W72-03078) (Knapp-USGS) W72-03105

COMPUTER MODELLING OF DIFFRACTION OF WIND WAVES,

California Univ., Berkeley.

S. S. Fan, and L. E. Borgman.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 473-487, 1970. 4 fig, 6 ref, 3 append.

Descriptors: *Simulation analysis, *Waves (Water), *Refraction (Water waves), Mathematical models, Data processing, Data collections, Frequency analysis.

Identifiers: Wave diffraction (Water).

A digital computer model was developed to simulate diffraction of wind waves behind a breakwater. The model combines hydrodynamic theories and the concept of directional spectra. It may be used not only for the study of the wind wave diffraction problem behind breakwaters but also for experimental (or field) data analysis procedures of other kinds. In addition, it can be used to determine: optimal data collection size; optimal maximum number of lags; and effects of smoothing on the spectral density estimates. For shorter data length, there is a great difference between the outputs of unsmoothed and smoothed cases. For very long record, there is no difference no matter whether data are smoothed or not. (See also W72-03078) (Knapp-USGS) W72-03106

INTERACTION BETWEEN WAVES AND CURRENTS,

Technical Univ. of Denmark, Lyngby.

I. G. Jonsson, C. Skougaard, and J. D. Wang.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 489-507, 1970. 6 fig, 2 tab, 8 ref.

Descriptors: *Waves (Water), *Currents (Water), *Water level fluctuations, *Wave pile-up, Bores, Ocean waves, Tides, Tidal effects, Ocean currents, Littoral drift.

Identifiers: *Wave-current interactions.

The interaction between surface gravity waves and a steady current was studied, assuming irrotational flow and a second order Stokes wave motion. A simple graphical method is given for the computation of the wave length in a current field. The concept of the mean energy level is introduced for a periodic wave motion with a steady current superimposed. This concept is used for the calculation of the 'current-wave set-down' for a two-dimensional motion with a constant discharge over a gently sloping bottom. A complete set of conservation equations is given for calculating current-wave set-down. Graphs and tables show the variation in length and height of wave for these conditions. (See also W72-03078) (Knapp-USGS) W72-03107

EXPERIMENTS OF WAVE REFLEXION ON IMPERMEABLE SLOPES,

Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).

C. de C. Moraes.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 509-521, 1970. 11 fig, 7 ref.

Descriptors: *Waves (Water), *Refraction (Water waves), Beaches, Slopes, Roughness (Hydraulic), Hydraulic models.

Identifiers: *Reflection (Water waves).

Tank experiments were used to study the reflective power of smooth and rough impermeable slopes. They show the importance of relative depth and the need for an adequate computational wave theory. Stokes 2nd order corrections help find a superior value for the reflexion coefficient. A regular scattering of experimental points was found in rough slope tests. The steeper the slope, the greater is the influence of roughness. (See also W72-03078) (Knapp-USGS) W72-03108

LIMITING CONDITION FOR STANDING WAVE THEORIES BY PERTURBATION METHOD,

Kyoto Univ. (Japan). Disaster Prevention Research Inst.

Y. Tsuchiya, and M. Yamaguchi.

Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 523-542, 1970. 15 fig, 2 tab, 6 ref.

Descriptors: *Waves (Water), *Standing waves, Coastal engineering, Model studies, Hydraulic models, Design, Loads (Forces), Pressure.

Identifiers: *Wave forces.

The validity and limiting conditions for the application of the finite amplitude standing wave theories by the perturbation method are outlined. In a numerical example, the errors of each order solution of these theories for two non-linear free surface conditions are computed for various kinds of wave characteristics. Some experiments on the wave pressure on a vertical wall by standing waves were carried out, and a plot of the limiting condi-

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tion for the application of these theories is based on comparison with theoretical curves. As an example of the application of these theories, the change of characteristics of wave pressure of standing waves accompanying the overtopping wave on a vertical wall is discussed. (See also W72-03078) (Knapp-USGS)
W72-03109

A HIGHER ORDER THEORY FOR SYMMETRICAL GRAVITY WAVES.

Wisconsin Univ., Madison. Dept. of Civil Engineering.
P. L. Monkmeyer.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 543-561, 1970. 2 fig, 2 tab, 27 ref, append.

Descriptors: *Waves (Water), *Analytical techniques, Mathematical studies, Equations, Numerical analysis, Computer programs, Ocean waves.
Identifiers: Water wave theory.

A higher order theory is presented for symmetrical, nonlinear gravity waves. The theory includes the full range of possible wave lengths, water depths, and wave heights that may be encountered. Linear and nonlinear waves, Airy waves, Stokes waves, cnoidal waves, and the solitary wave, are encompassed. A complex potential in the form of an infinite series describes the flow field. The potential satisfies the bottom (horizontal) condition as well as the kinematic surface condition exactly. Furthermore, the dynamic surface condition is satisfied by numerical calculation of the series coefficients which appear in the complex potential. The calculation of these coefficients is accomplished by solving a set of nonlinear algebraic equations, with the aid of a Newton-Raphson iteration procedure and matrix inversion. Coefficients of the complex potential for a fifth order analysis are presented in tabular form. (See also W72-03078) (Knapp-USGS)
W72-03110

ANALYTICAL APPROACH ON WAVE OVERTOPPING ON LEVEES.

Asian Inst. of Tech., Bangkok (Thailand).
H. Shi-igai, and T. Kono.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 1; American Society of Civil Engineers, New York, NY, p 563-573, 1970. 4 fig, 1 tab, 8 ref.

Descriptors: *Waves (Water), *Levees, *Coastal structures, *Design, *Coastal engineering, Water levels, Weirs, Flow, Computer programs, Forecasting, Stochastic processes, Statistical models, Mathematical models.

An analytical approach is used to evaluate the amount of overtopping of levees by waves. Wave overtopping is considered similar to flow over a weir with change of depth with respect to time. Wave overtopping is a combination of statistical and deterministic factors, since wave period and wave height, for example, are statistical variables, while overtopping caused by a given wave can be a deterministic phenomenon. If the frequency response is known, the total amount of wave overtopping can be estimated if all the wave characteristics are known. (See also W72-03078) (Knapp-USGS)
W72-03111

IMPULSE WAVES GENERATED BY LANDSLIDES.

Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
J. W. Kamphuis, and R. J. Bowering.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington,

DC, Volume 1; American Society of Civil Engineers, New York, NY, p 575-588, 1970. 10 fig, 10 ref.

Descriptors: *Waves (Water), *Tsunamis, *Bores, *Landslides, Model studies, Hydraulic models, Earthquakes, Ocean waves.
Identifiers: *Impulse waves (Water).

Impulse waves are generated by landslides originating entirely above the water surface. The characteristics of this wave depend mainly on the slide volume and the Froude number of the slide upon impact with the water. The resulting wave goes through a transition period. For the highest wave (usually the first), the wave height becomes stable relatively quickly and decays exponentially during the period of transition, and the wave period continues to increase for a long time. The velocity of propagation may be approximated very closely by solitary wave theory. (See also W72-03078) (Knapp-USGS)
W72-03112

WAVES GENERATED BY A PISTON-TYPE WAVEMAKER.

Army Coastal Engineering Research Center, Washington, D.C. Research Div.
O. S. Madsen.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C., Volume 1; American Society of Civil Engineers, New York, NY, p 589-607, 1970. 3 fig, 2 tab, 14 ref.

Descriptors: *Waves (Water), *Hydraulic models, *Calibrations, *Water level fluctuations, Design, Analytical techniques, Laboratory tests.
Identifiers: Wave-makers (Laboratory).

When a wavemaker generates a finite number of waves, one of the first and one of the last waves in such a burst is considerably larger than the average. A mathematical model, based on the linearized governing equations, is used for the particular problem of the waves generated by a sinusoidally moving piston-type wavemaker starting from rest. Theoretical results for the magnitude of the large wave relative to the average agree fairly well with experiments; however, the actual wave height is smaller in the experiments than predicted by theory. Because pistons rarely fit the tank dimensions exactly, the discrepancy between predicted and observed wave heights can be attributed to the effects of leakage around the piston. (See also W72-03078) (Knapp-USGS)
W72-03113

PREDICTION CURVES FOR WAVES NEAR THE SOURCE OF AN IMPULSE.

Chicago Univ., Ill. Dept. of Geophysical Sciences.
Robert L. Miller.
Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C., Volume 1; American Society of Civil Engineers, New York, NY, p 609-624, 1970. 16 fig, 11 ref.

Descriptors: *Waves (Water), *Bores, *Tsunamis, Seiches, Landslides, Earthquakes, Model studies, Hydraulic models, Ocean waves.
Identifiers: Impulse waves.

The general problem of single-impulse induced waves was studied in wave tanks. The wave modes to be expected for various permutations of displacement velocity and displacement length at the impulse sources are given in graphic form. The parameters of the impulse may thus be adequately described by the dimensionless variables x/d (where x is distance the piston is displaced, and the constant, d , is the undisturbed water depth) and a piston Froude number. The impulse waves undergo transformations and decay as they progress down channel. Two velocities were measured. The first is a 'phase velocity.' Fixed points on the wave profile were traced on multichannel

oscillograph records. The second velocity in this study is the Boussinesq velocity of propagation of a volume element of the impulse wave. The fully developed bore decays rapidly to the unbroken undular bore form. The lead wave of the undular form takes on the 'solitary' mode leaving behind the rest of the 'undular' wave. In several cases, the second and even the third undulations in turn take on the 'solitary' mode. The 'sinusoid' mode generated at short piston displacements transforms gradually as the trailing trough rises to the undisturbed water level, and finally enters the 'solitary' mode. (See also W72-03078) (Knapp-USGS)
W72-03114

IMPROVEMENT OF NAVIGATION CONDITIONS, CONNEAUT HARBOR, OHIO; HYDRAULIC MODEL INVESTIGATION.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. Y. Hudson, and H. B. Wilson.
Available from the National Technical Information Service as AD-724 140, \$3.00 in paper copy, \$0.95 in microfiche. Rept no. AEWES-TR-2-617, Jan 1963, 93 p, 5 tab, 59 fig, 5 ref.
Identifiers: *Breakwaters, *Hydraulic models, *Great Lakes, Harbor models, Lake waves, Storms, Navigation, Test methods, Mechanical drawings, Photographs, Ohio, Conneaut Harbor, Seiches, Lake Erie.

A hydraulic model investigation of the harbor at Conneaut, Ohio, was conducted to determine the effects on waves and seiche currents at the entrance to and within the inner-harbor area of various proposed modifications to the east pier and extensions to the east breakwater. The study was performed on a 1:125-scale, fixed-bed-type-model constructed of concrete and equipped with a wave generator, electrical wave-height measuring and recording devices, and a water circulating system for simulating currents resulting from the action of longitudinal seiches characteristic of Lake Erie.
W72-03138

WAVE AND SURGE CONDITIONS AFTER PROPOSED EXPANSION OF MONTEREY HARBOR, MONTEREY, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
C. E. Chatham, Jr.
Available from the National Technical Information Service as AD-723 954, \$3.00 in paper copy, \$0.95 in microfiche. Rept no. AEWES-TR-H-68-9, Sep 1968, 19 tab, 62 fig, 14 ref.
Identifiers: *Breakwaters, *Hydraulic models, *Harbors, California, Harbor models, Ocean waves, Storms, Navigation, Ocean currents, Test methods, Monterey Harbor, Monterey (California).

A 1:120-scale model of Monterey Harbor, California, and sufficient offshore area to permit generation of the required test waves was used to investigate the arrangement and design of certain proposed harbor improvements with respect to wave and surge action and to determine current conditions in the navigation entrances to the harbor and its basins. The proposed harbor improvements consisted of (1) enlarging the present harbor by construction of a detached north breakwater, approximately 1100 ft seaward, and (2) development of the inner-harbor area by constructing moles to form two additional basins for the anchorage of small pleasure craft. A 56-ft-long wave machine and electrical wave height measuring and recording apparatus were utilized in model operation. Base tests were conducted with existing prototype conditions installed in the model. Results of tests involving the various improvement plans were compared with base test results to determine the relative effectiveness of the various plans. An analytical study of long-period sea-energy oscillations in the vicinity of Monterey Bay with respect to the possibility of related response in Monterey Harbor was conducted.

W72-03139

KASKASKIA RIVER NAVIGATION PROJECT, ILLINOIS; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. Franco, and C. D. McKellar, Jr.
Available from the National Technical Information Service as AD-723 959, \$3.00 in paper copy, \$0.95 in microfiche. Rept no. AEWES-TR-H-69-1, Jan 1969, 8 tab, 27 fig.

Identifiers: *Dams, *Hydraulic models, *Rivers, Navigation, Design, Civil engineering, River currents, Fluid flow, Construction, Test methods, Mechanical drawings, Illinois. Kaskaskia River, Locks (Waterways), Spillways, Stilling basins.

The proposed Kaskaskia River navigation project will provide a 50-mile-long, 9-ft-deep by 200-ft-wide channel from the mouth of the river to Fayetteville, Ill., by means of channel enlargement and realignment; alterations to bridges to obtain proper clearance; and construction of a gated dam surmounted by two 60-by 30-ft tainter gates, and an 84-by 600-ft navigation lock. A 1:120-scale, fixed-bed model, reproducing 2.0 miles of the Kaskaskia River and 1.8 miles of the Mississippi River, was used to: demonstrate and study flow conditions in lock approaches and in critical reaches; determine adequacy of proposed design for the spillway, stilling basin, and exit channel; determine optimum arrangement of the guide or guard walls; determine areas requiring special protection and navigation conditions in lock approaches and in critical reaches; and develop modifications required to produce satisfactory flow and navigation conditions.

W72-03140

FILLING AND EMPTYING SYSTEM DARDANELLE LOCK, ARKANSAS RIVER; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

H. Ables, Jr., and M. B. Boyd.
Available from the National Technical Information Service as AD-723 958, \$3.00 in paper copy, \$0.95 in microfiche. Rept no. AEWES-TR-H-69-5, Apr 1969, 13 tab, 26 fig, 4 ref.

Identifiers: *Dams, *Hydraulic models, Hydraulic systems, Civil engineering, Fluid flow, Test methods, Mechanical drawings, Photographs, Tables, Arkansas, Dardanelle Dam, Arkansas River, Culverts, *Locks (Waterways), Filling, Emptying.

Dardanelle Lock will be 110 ft wide by 670 ft long and will provide a maximum lift of 54 ft. Results of model tests to determine the suitability of a longitudinal floor culvert filling and emptying system for the lock are presented herein. The recommended system includes intake manifolds in the approach walls, a 14.5-ft-wide by 13-ft-high culvert in each wall, a lateral crossover culvert at the midpoint of the lock leading to four 15-ft-wide by 8-ft-high longitudinal floor culverts, and culvert outlets located riverward of the lock in a common basin. Each floor culvert has nine pairs of 1.57-ft-wide by 4-ft-high side ports spaced 16 ft on centers, resulting in a port-to-culvert area ratio of 0.94. The port manifolds in each end of the lock cover 19 percent of the chamber length and are centered at the upstream and downstream quarter points of the lock chamber. Baffles were used along the center line of the lock and along lock walls opposite port manifolds.

W72-03141

EXPANSION OF SANTA BARBARA HARBOR, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

W. Brasfield, and J. W. Ball.
Available from the National Technical Information Service as AD-723 938, \$3.00 in paper copy, \$0.95 in microfiche. Rept no. AEWES-TR-2-805, Dec 1967, 78 p, 5 tab, 21 fig, 7 ref.

Identifiers: *Breakwaters, *Hydraulic models, Harbor models, Storms, Ocean waves, Test methods, California, Santa Barbara Harbor.

Plans have been formulated for expansion and improvement of a smallcraft harbor at Santa Barbara, Calif., for use by increasing numbers of pleasure craft, commercial fishing boats, and oil exploration boats. The area that will be enclosed by a proposed breakwater system, and sufficient adjacent coastline and offshore bathymetry to permit accurate simulation of storm-wave action were reproduced in a 1:100-scale hydraulic model equipped with wave-generating and wave-measuring devices. The purpose of the model study was to evaluate the effectiveness of various elements of the proposed design in providing protection from storm-wave-action, and to develop a satisfactory plan of improvement with respect to wave-height criteria established for various portions of the harbor. The proposed plan of improvement, with some modifications, will effectively reduce incoming storm waves to a satisfactory level in the entrance channel and the inner harbor.

W72-03142

DECISION MAKING UNDER UNCERTAINTY IN SYSTEMS HYDROLOGY,
Arizona Univ., Tucson. Hydrology and Water Resources Interdisciplinary Program.

For primary bibliographic entry see Field 06A.
W72-03166

8C. Hydraulic Machinery

OPERATING GUIDELINES FOR MULTIPLE-PURPOSE RESERVOIRS,
Missouri Univ., Columbia.

For primary bibliographic entry see Field 06A.
W72-03186

INTEGRAL INSULATION SHIELDING FOR POWER CABLES - A SIMPLE SOLUTION TO A SERIOUS DILEMMA,
Cyprus Mines Corp., Rome, N.Y.

For primary bibliographic entry see Field 08G.
W72-03203

HYDROELECTRIC POWER POLICY,
National Water Commission, Arlington, Va.

For primary bibliographic entry see Field 06B.
W72-03295

POWER GENERATION AND ENVIRONMENTAL CHANGE,
American Association for the Advancement of Science, Washington, D.C. Committee on Environmental Alteration.

For primary bibliographic entry see Field 05G.
W72-03330

RADIATION DOSE LIMITS,
Maryland Academy of Sciences, Baltimore. Study Panel on Nuclear Power Plants.

For primary bibliographic entry see Field 05G.
W72-03332

8D. Soil Mechanics

THE PROBLEM OF PILE GROUP-PILE CAP INTERACTION,
R. Butterfield, and P. K. Banerjee.

Geotechnique, Vol 21, No 2, p 135-142, June 1971. 8 p, 6 fig, 8 ref.

Descriptors: *Pile foundations, *Piles (Foundations), Load distribution, Compressibility, Soil mechanics, Elastic theory, Stress, Foundations. Identifiers: Great Britain, *Elastic foundations, Vertical displacements, *Pile caps, Pile spacing, Pile bearing capacities.

Load displacement behavior of a pile group-pile cap system is of major importance to foundation engineers. Most available field and laboratory studies on piles have been concerned with single piles or with groups of piles where the cap does not make contact with the ground. This elastic analysis considers two problems concerning the interaction with the supporting ground of an arbitrarily spaced group of piles embedded in smooth ground contacting a pile cap of any shape: the load displacement behavior of the system, and the load distribution between the piles in the group and the cap. The problems are formulated as an integral equation developed from Mindlin's analysis for a point load embedded within a semi-infinite ideal elastic half space. The effect on the response of the system of the pile length to diameter ratio, pile cap size, and the compressibility ratio of the pile and supporting medium has been investigated. Results are presented graphically for a single pile with a square cap and typical pile groups in square and rectangular arrays. (USBR)

W72-03200

FLOATING FOUNDATIONS FOR CONTROL OF SETTLEMENT,
Lambe Associates, Inc, Concord, Mass; and Massachusetts Inst. of Tech., Cambridge.

D. J. D'Appolonia, and T. W. Lambe.
Proceedings, American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, Vol 97, No SM6, p 899-915, June 1971. 17 p, 13 fig, 4 tab, 15 ref, 2 append.

Descriptors: *Foundations, *Floating, *Settlement (Structural), Clays, Buildings, Soil stability, Soil profiles, Heaving, Pore pressure, Consolidation, Soil mechanics, Shear stress. Identifiers: FERMIT, Design analysis, Massachusetts Institute of Technology.

Floating foundations are an effective means for reducing the settlement caused by placing heavy loads on deep deposits of soft clay. Some fundamental design considerations concerning heave and settlement of floating foundations are examined. The performance of 5 floating foundations on the MIT campus is evaluated. Investigation of the consolidation history of the clay deposit and consideration of foundation stability during excavation are crucial to the proper performance of floating foundations. Floating foundations for 5 MIT buildings have performed well. Maximum settlements vary from 0.05 to 0.15 ft; differential settlements are very small. (USBR)

W72-03201

APPLICATION OF INSTRUMENTATION TO EARTH DAMS,
Rofe, Kennard and Lapworth, London (England).

B. H. Rofe, and P. F. Tye.
Journal of the Institution of Water Engineers, Vol 25, No 3, p 137-159, May 1971. 23 p, 6 fig, 12 ref, disc.

Descriptors: *Earth dams, *Instrumentation, *Rockfill dams, Foreign construction, Foreign design practices, Dam construction, *Application methods, Structural behavior, Piezometers, Settlement (Structural), Gages, Strain gages, Observation wells. Identifiers: Draycote Water Reservoir (Gt Brit), Ardlough Reservoir (Gt Brit), Horizontal movement, Great Britain, Inclometers, Pressure cells.

The variety of instruments that have become available as a result of advances made during the last 10 years has enabled water engineers involved in the design and construction of earth dams to obtain information on the behavior of earth masses during construction and continuing throughout the lifetime of the structure. Instruments used for measuring pore pressure, strains, movements, and their advantages and disadvantages, are described. An assessment of the probable reliability is also given. A particular application of these instruments for Draycote Water and Ardlough Reservoirs is described. Methods of reading and record-

Field 08—ENGINEERING WORKS

Group 8D—Soil Mechanics

ing the instruments and suggestions for documenting and circulating the information obtained are discussed. Engineers would be able to obtain better reliability and longer service life from instrumentation if the instruments were more ruggedly constructed. (USBR)
W72-03202

OBSERVED AND PREDICTED DEFORMATIONS IN A LARGE EMBANKMENT DAM DURING CONSTRUCTION.
Building Research Station, Watford (England).
A. D. M. Penman, J. B. Burland, and J. A. Charles.
Paper 7403, Institution of Civil Engineers Proceedings, Vol 49, p 1-21, May 1971. 21 p, 17 fig, 2 tab, 17 ref, 2 append.

Descriptors: *Earth dams, *Deformation, *Movement, instrumentation, *Forecasting, Dam design, Dam stability, *Rockfill dams, Density, Compressibility, Stress.
Identifiers: Great Britain, Observational method, Scammonden Dam (Great Britain), Finite element method.

Accurate measurements of movements of a large number of points on the main cross section of Scammonden Dam, Great Britain, during construction enabled a detailed comparison to be made with the movements predicted from the properties of the fill and foundation material by an analysis using finite element techniques. An analysis was made on the assumption that the soil behaves elastically. This simplified analysis gave results reasonably in agreement with observation, indicating that the method is sufficiently accurate for design purposes. In addition to the existing design methods used to ensure the stability of the dam, this analysis enables prediction of movements within the structure and permits making necessary modifications during design to keep these movements within acceptable limits. (USBR)
W72-03204

NEW METHOD FOR DETERMINATION OF TENSILE STRENGTH OF SOILS.
Lehigh Univ., Bethlehem, Pa.
H. Y. Fang, and W. F. Chen.
Highway Research Record, No 345, p 62-68, 1971. 7 p, 10 fig, 20 ref.

Descriptors: *Tensile strength, *Soils, *Soil tests, Soil mechanics, *Soil strength, Cracking, Failure, Cohesive soils, Plastic theory, Test results, Theoretical analysis, Bearing capacity, Laboratory tests, Field tests.
Identifiers: *Double punch test, Schematic diagrams.

The double punch test is a new and simple technique for determining the tensile strength of soils. Two steel discs are centered on the top and bottom surfaces of a cylindrical soil specimen; then a vertical load is applied slowly on the discs until the specimen cracks. The tensile strength of the specimen can be calculated from the maximum load by using a simple formula based on the perfect plasticity theory. The fundamental relationship between tensile strength of the soil and the density-moisture content with various compactive efforts is given. Comparisons are made of tensile strength determined from the double punch test and split tensile tests for various materials. Good agreement between the 2 tensile strength tests is indicated. This method for determining the tensile characteristics of soils is applicable to both laboratory and field testing. (USBR)
W72-03209

CHART SOLUTIONS FOR ANALYSIS OF EARTH SLOPES.
Virginia Polytechnic Inst. and State Univ., Blacksburg; and Idaho Univ., Moscow.
J. H. Hunter, and R. L. Schuster.
Highway Research Record No 345, p 77-89, 1971. 13 p, 14 fig, 12 ref.

Descriptors: *Slope stability, Soil mechanics, *Charts, Pore pressure, Cohesion, Safety factors, Embankments, Failure, Cohesionless soils, Earth dams, Drawdown, *Slopes, Plasticity index, Highway engineering, Fills.
Identifiers: Taylors theory, Friction circle method, *Stability analysis cuts, Cut slopes.

This paper compiles several practicable chart solutions for the slope stability problem and is concerned with the use of the solutions rather than their derivations. The work of Taylor, Bishop and Morgenstern, Morgenstern, Spencer, Hunter, and Hunter and Schuster is presented. In addition to the working assumptions and parameter definitions of each writer, the working charts are introduced, and sample problems are included. The chart solutions cover a wide variety of conditions: they may be used to rapidly investigate preliminary designs and to obtain reasonable estimates of parameters for more detailed packaged computer solutions. In some cases, the charts may be used for the final design process. (USBR)
W72-03211

8E. Rock Mechanics and Geology

GEOLOGY AND DAMS.

All-Union State Inst. 'Gidroeenergoproekt', Moscow (USSR).
For primary bibliographic entry see Field 08A.
W72-02977

THE CSIR 'DOORSTOPPER' AND TRIAXIAL ROCK STRESS MEASURING INSTRUMENTS.
National Mechanical Engineering Research Inst., Pretoria (South Africa).
E. R. Leeman.
Rock Mechanics, Vol 3, No 1, p 25-50, 1971. 26 p, 16 fig, 4 tab, 20 ref, append.

Descriptors: *Strain gages, Geologic investigations, *Strain measurement, Stress, Strain, Stress relieving, Rock mechanics, *Stress analysis, Equations, Boreholes.
Identifiers: *Doorstoppers, Simulators, *Triaxial cell, Rosette, South Africa, Overcoring method.

The doorstopper and triaxial strain cells were designed specifically to determine the absolute stress in rock using an overcoring stress relieving technique. The doorstopper measures the major principal stress in situations where its direction and those of the 2 other principal stresses are either known or assumed. The triaxial strain cell determines the complete state of stress in a single borehole drilled in any direction in any stress field, and would appear to supersede the doorstopper. There are situations, however, where it might be impossible to obtain the required 50 cm core length for a satisfactory stress relief cycle. The doorstopper requires only a 50 mm core length. Descriptions of the CSIR doorstopper and triaxial rock stress measuring instruments, and the principles underlying their use, are given. The derivations of the theoretical formulas used to calculate stresses from the measured strains are included. (USBR)
W72-03199

A METHOD OF INTEGRAL SAMPLING OF ROCK MASSES.
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
M. Rocha.
Rock Mechanics, Vol 3, No 1, p 1-12, 1971. 12 p, 16 fig.

Descriptors: *Core drilling, *Cores, *Sampling, Boreholes, Drill holes, *Geologic investigations, Geology, Rock properties, Fractures (Geology), Rock mechanics.
Identifiers: *Core recovery, Overcoring method, Portugal, *Recovery.

A new sampling method which yields 100% core recovery from rock masses has been developed. A borehole is drilled to the depth where the sample is to be taken and another smaller hole is drilled at the bottom of the borehole, coaxial with it, to the desired length of the core sample. A perforated rod is placed in the smaller hole to reinforce the rock mass, after which a binding agent is injected into the rod. The binding agent passes through the perforations and bonds the adjacent rock to the rod. When the binding agent hardens sufficiently, the reinforced zone of the rock mass is overcored and the integral sample is removed. This method can be used in a borehole throughout its length, or only in the zones where rock conditions would yield very low core recoveries by ordinary coring methods. The main advantage of this method is that all rock mass features and their orientation can be observed. Additionally, the samples can be tested to determine the properties, particularly mechanical properties, of different types of fractures, including their infillings and weak zones. (USBR)
W72-03205

FINITE ELEMENT ANALYSES OF ELASTIC-PLASTIC PROBLEMS IN THE MECHANICS OF GEOLOGIC MEDIA: AN OVERVIEW.
Montana School of Mines, Butte; and Pennsylvania State Univ., University Park; and Continental Oil Co., Ponca City, Okla.
W. G. Parisseau, B. Voight, and H. D. Dahl.
Proceedings 2d Congress of the International Society on Rock Mechanics, Belgrade, Yugoslavia, p 311-323, Sept 1970. 13 p, 9 fig, 93 ref.

Descriptors: *Rock mechanics, *Analytical techniques, Soil mechanics, Anisotropy, Heterogeneity, Mathematical models, Plasticity, Stress distribution, Geology, Gravity, Deformation.
Identifiers: Elastics, *Finite element method, Matrix methods.

Matrix structural analysis of geotechnical problems by finite element methods has attained operational status in only a few years. During this period the linear elastic approach to boundary value problems in rock and soil mechanics has been found not realistic or adequate in all cases. Certain serious difficulties encountered in the application of finite element methods to elastic-plastic problems in geologic materials are reviewed. The appropriateness of plasticity theory in the development of constitutive equations is critically examined. Questions on the accuracy of input data for finite element solutions are discussed. Particular attention is given to the phenomenon of path dependency in elastic-plastic problems. (USBR)
W72-03206

STRESS-DEFORMATION AND STABILITY ANALYSES OF DEEP BOREHOLES.
Army Engineer Waterways Experiment Station, Vicksburg, Miss; and Texas Univ., Austin.
C. S. Desai, and L. C. Reese.
Proceedings, 2d Congress of the International Society on Rock Mechanics, Belgrade, Yugoslavia, p 475-484, Sept 1970. 10 p, 9 fig, 15 ref.

Descriptors: *Boreholes, *Stress analysis, Pore pressure, Rock properties, Rock mechanics, Mohr envelope, Mohr circle, Elastic limit, Pressure, Plasticity, Deformation, Stability, Earth pressure, Test results, Fluids.
Identifiers: Green River Formation, *Finite element method.

The problem of stress-deformation and stability analyses of deep boreholes drilled in a rock mass, subjected to geostatic loading or fluid pressures, is studied. Available analytical solutions for this problem, based on many simplified assumptions, are generally inadequate for field conditions. Numerical solutions are obtained by using the finite element method, which takes into account com-

plex boundary conditions, arbitrary variations in material properties and nonlinear stress-strain behavior. The problem of a borehole subjected to hydrostatic pressures is studied. Results from the finite element method are compared with experimental results from tests conducted on photoelastic models. Good agreement is obtained between the two results. The finite element method is further applied to study the stability of a borehole drilled in a Green River shale. The material is treated as nonlinear, elastic, non-homogeneous, and locally isotropic. Indirect use of the incremental load method is made to simulate the progress of drilling. The advent of plastic action on the basis of Mohr criterion and the development of elastic and forward plastic zones that contribute the stability of the borehole are studied. The critical depth of collapse is determined. (USBR)

W72-03207

ON THE PROBLEM OF BOREHOLE STRENGTH TESTING, California Univ., Berkeley.

K. Drozd.

Proceedings, 2d Congress of the International Society on Rock Mechanics, Belgrade, Yugoslavia, p 325-333, Sept 1970. 9 p, 10 fig, 4 tab, 4 ref.

Descriptors: *Boreholes, Stress analysis, Shear, Rock properties, Rock mechanics, Soil properties, Soil mechanics, *In situ tests, Instrumentation, Deformation, Earth pressure, Test results, Tensile properties, Tensile strength, Fractures (Geology). Identifiers: Borehole deformation gage, Borehole extensometers, *Jacking tests, Brittle fractures.

Instruments such as dilatometers and borehole jacks measure the deformability of rocks in boreholes. These instruments might measure strength values of the borehole wall rock if the loading were carried to sufficiently high levels. The failure of rock under uniaxial plate loading of the walls of a borehole was studied by physical model tests to define the modes of behavior and by mathematical study to reveal the functional relationships. Both rock-like and soil-like materials were studied; tension fracturing and punching were observed in brittle porous materials. Classical bearing capacity failures were never observed in the model studies, because of the high confinement around the borehole and the large stroke necessary to thrust the material below the plate into the borehole. An instrument predicated on plate jacking tests of the walls of a borehole can estimate the tensile strength of a continuous rock body or yield a number which correlates with the shearing strength of a discontinuous rock mass. Information may also be obtained on the in situ stresses when the tensile strength is known. (USBR)

W72-03208

FRICTION OF ROCKS AND STABILITY OF ROCK SLOPES,

Australian National Univ., Canberra.

J. C. Jaeger.

Geotechnique, Vol 21, No 2, p 97-134, June 1971. 42 p, 39 fig, 1 tab, 115 ref.

Descriptors: *Rock mechanics, *Friction, *Sliding, *Failure, *Joints (Geology), *Constraints, Rock properties, Rockslides, Mechanical properties, Tensile stress, Shear tests, Shear failure, Fractures (Geology), Rocks, Stress, Stress analysis.

Identifiers: Wear, Sliding tests, Australia, Rankine lectures, *Rock slope stability.

The similarities and differences between soil and rock mechanics are discussed, and place particular emphasis on slope stability. The effects of constraints and of the stiffness of the system applying stress are of greater importance in rock mechanics. The criteria for failure of rocks are mostly empirical and lead to linear or power laws.

Similar laws might be expected to hold for friction. While the Coulomb law is generally adequate for soils, the frictional behavior of rocks seems to be better described by a nonlinear law. Methods for measuring friction, and their limitations, are discussed. The process of wear and the contact area of sliding surfaces are considered. Residual values of friction are sometimes attained after small amounts of sliding. Because numerical values for friction are uncertain, simple formulas are useful. Formulas for factors of safety for sliding on 1 or 2 plane surfaces are given. (USBR)

W72-03210

8G. Materials

INTEGRAL INSULATION SHIELDING FOR POWER CABLES - A SIMPLE SOLUTION TO A SERIOUS DILEMMA,

Cyprus Mines Corp., Rome, N.Y.

R. C. Graham.

Underground Engineering, Vol 2, No 4, Part I, p 19-22 and Part II, p 22-44, June-July 1971. 10 p, 7 fig, 4 tab, 4 ref.

Descriptors: *Electric cables, Electrical insulators, *Semiconductors, Electrical conductance, *Coatings, Electric coronas, Test procedures, Test results, Electrical design, Electrical properties, Electric power.

Identifiers: Cable terminations, Bend tests, *Splicing, *Shielding, Underground cables, Tensile properties.

The use of adherent, flexible conducting coatings or paints as an electrostatic shield applied directly to the outer surface of solid cable insulations has been a recognized practice. A new material has been developed, that provides an almost electrically perfect shielding system, when applied to the insulation surface of most power cables and enclosed by the proper semiconducting tape, followed by suitable metallic drainage. Other features include favorable economics for certain cable types and sizes, dimensional advantages, low and uniform resistivity, physical permanency, simplified terminating and splicing procedures and elimination of complex cable manufacturing processes associated with today's more conventional forms of shielding. The theory, history, product data, summary and comparison of various semiconductive insulation shields, identification methods, cable designs, suggested terminating and splicing procedures, specification references, together with a discussion of present and future considerations involving actual use in power cables, are reviewed. A complete series of tests, test results, and other related information obtained on sample and production length of modern primary distribution cable are described. (USBR)

W72-03203

STRUCTURAL STRENGTHS OF PIPE MATERIALS,

Utah State Univ., Logan. Engineering Experiment Station.

R. K. Watkins.

Preprint, presented at Water Pollution Control Federation Conference, 44th, Session 23, No. 2, October 7, 1971. 23 p, 10 fig.

Descriptors: *Pipe, *Soil properties, Buckling, Deformation, Yield strength, Tensile stress, Loading distribution, Pressure, Poisson's ratio, Soil density, Water pollution control.

Identifiers: Performance limit, Bursting, Hoop stress, *Soil compression, Ring deflection, Buckingham pi theorem.

Some new research and experience in analyzing the strength of pipe is making control of water pollution by transporting water in pipes more feasible. Usually the first consideration in the design of a water pipe is the hoop strength which determines the allowable pressure in the pipe. It has been found, however, that a more realistic performance

limit is deformation—that deformation beyond which the pipe cannot perform adequately. The five pertinent pipe properties that were considered were: (1) strength of material; (2) ring stiffness; (3) wall cross sectional area per unit length; (4) diameter; (5) some identifiable deformation at performance limit. Deformation includes ring deflection at joint leakage, deformation of wall rushing or buckling, formation of plastic hinges, etc. Pertinent soil properties also had to be considered before a pipeline could be designed. Soil compression was found to be one of the most important of the soil properties. In loose, compressible soils, the ring diameter decreases vertically and increases horizontally, and if the ring is very flexible a reversal of curvature may result. A stiff noncompressible soil will arch over and protect the pipe because the soil supports a significant fraction of the vertical load. So the two most important soil properties were found to be (1) stiffness of the soil and (2) the vertical soil strain due to the anticipated pressure at the level of the top of the pipe. Because test data are not yet adequate to supply the complete interrelationship for all pipe and soil types, the traditional design method will be continued. This design method was then discussed. (Biggs-Texas)

W72-03355

A CORROSION INHIBITOR PROCESS FOR DOMESTIC WATER,

Long Beach Dept. of Water, Calif.

For primary bibliographic entry see Field 05G.

W72-03367

8H. Rapid Excavation

USE OF NUCLEAR EXPLOSIVES FOR WATER RESOURCES DEVELOPMENT IN ARID REGIONS,

Stanford Univ., Calif. Dept. of Civil Engineering.

V. Retief, and P. Kruger.

Available from the National Technical Information Service as SU-326-P-31-2, \$3.00 in paper copy, \$0.95 in microfiche. Report SU-326-P-31-2, June 1971. 108 p.

Descriptors: *Nuclear explosions, *Reservoir construction, *Tritium, Radioactivity, Radioactivity techniques, Water pollution treatment, Craters, Reservoir leakage, Reservoir evaporation, Reservoir design, Irrigation, Arid lands, Sediment load, Runoff forecasting.

Feasibility is studied in relation to the hydrology of arid regions (variable precipitation, erratic runoff, high evaporation, salinity and large sediment load). Ground shock and air blast may require that the construction site be located in a remote area. Craters with a storage capacity larger than 10,000 acre ft can deliver water at a price less than \$37/acre ft, which is the upper limit of price of irrigation water. A 100,000 acre ft reservoir can deliver water at a cost of \$14/acre ft. Tritium contamination of surface and ground water is the most important problem in the utilization of crater reservoirs. Due to its mobility, however, tritium can be washed out of the rubble by a few cycles of flooding and draining, especially in the case of a crater in hard rock, where the rubble will have low retention. Water with a high level of contamination can be disposed of by direct evaporation. (Bopp-ORNL)

W72-03323

INNATE CONTROL OF MIGRATIONS OF SALMON AND TROUT FRY FROM NATAL GRAVELS TO REARING AREAS,

Pennsylvania State Cooperative Fishery Univ., University Park.

Robert F. Raleigh.

Ecology, 52 (2): 291-297. Illus. Map. 1971.

Identifiers: Control, Donor, Fry, Gravels, Innate, Migrations, Natal, Oncorhynchus-Nerka, Rearing, Salmo-Clarki, Salmo-Gairdneri, *Salmon, Stocks, *Trout.

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Group 8H—Rapid Excavation

The upstream and downstream directional responses of demes of sockeye salmon (*Oncorhynchus nerka*) fry from inlet and outlet streams hatched and reared under controlled, identical conditions were tested in the laboratory. The tests compared innate directional responses of fry from the 2 sources to variables of water source and temperature. Both variables influenced the directional responses of the fry. The direction of migration (upstream for outlet fry or downstream for inlet fry) and response to changes in the test variables differed substantially between fry from inlet or outlet streams; this response difference held for populations of sockeye salmon from different geographical locations (Canada and Alaska). The differences were concluded to be innate in origin. Single tests of fry of rainbow (*Salmo gairdneri*) and cutthroat (*S. clarki*) trout from inlet and outlet streams indicated that directional responses of fry from these species are also innately influenced. The significance of matching the innate responses of donor stocks of fish to the characteristics of a recipient environment is discussed.—Copyright 1971, Biological Abstracts, Inc.
W72-03486

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

WATER RESOURCES INVESTIGATIONS IN FLORIDA, 1971.

Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 09D.
W72-03068

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES INVESTIGATIONS IN FLORIDA, 1971.

Geological Survey, Tallahassee, Fla. Water Resources Div.

Geological Survey Report, November 1971. 140 p.

Descriptors: *Water resources development, *Florida, *Reviews, *Projects, *Cooperatives, Programs, Surface waters, Groundwater, Estuaries, Canals, Beaches, Bridges, Hydrologic data, Data collections, Watershed management.
Identifiers: Progress reports, Summaries.

Summary statements are presented for 177

cooperative water resources investigations in Florida during the fiscal year ending June 1971. These investigations made by the Water Resources Division of the U.S. Geological Survey in cooperation with many state, federal, and local agencies are part of the overall program of appraising the nation's water resources. In addition, investigations which have been initiated subsequent to July 1, 1971 are listed. In Florida, water resources appraisals are highly diversified ranging from hydrologic records networks to interpretative appraisals of water resources and applied research to develop investigative techniques. This report is intended as a method of informing those agencies interested in the water resources of Florida of the current status of the U.S. Geological Survey cooperative program. Preceding the summaries is a list of 62 agencies which cooperated formally in the statewide water resources program and a list of the investigations included in the program for 1971. (Woodard-USGS
W72-03068

10. SCIENTIFIC AND TECHNICAL INFORMATION

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Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

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W72-03350

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In the second part, the focus shifts to the analysis of the recorded data. The author provides a detailed breakdown of the various categories of expenses and revenues, highlighting trends and patterns that can be used for strategic planning. This analysis is presented in a clear and concise manner, making it easy for stakeholders to understand the financial performance of the organization.

The third part of the document addresses the challenges faced in the process of financial reporting. It discusses the common pitfalls and offers practical solutions to avoid them. The author also provides a checklist of key items to verify before finalizing the reports, ensuring that all necessary information is included and that the data is accurate and reliable.

Finally, the document concludes with a summary of the key findings and recommendations. It reiterates the importance of transparency and accountability in financial management and encourages the implementation of the suggested practices to improve the overall financial health of the organization.



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National Water Commission	W72-03290--03295	6

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.

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